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From restructuring to sustainable development

The case of Upper Silesia

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EXECUTIVE SUMMARY

Three Challenges for Silesia

- In the coming decades the Silesian Voivodeship can achieve a level of development close to that of the prosperous countries of Western Europe. **However, this requires completing the socio economic transition** and dealing with three challenges:
 - **economic challenge** – further development of a competitive industrial base and market services is necessary to raise the level of GDP per capita of the region to that of the well-developed European countries,
 - **demographic challenge** – the decline in the number of inhabitants of the region and the process of fast ageing of the population, which is particularly intensive in the communities which in the past based their development on coal mining, has to be stopped,
 - **social challenge** – improvement of the quality of life in the region means solving the problem of a high level of air pollution, and also supporting the areas with a high unemployment rate, poverty and increased crime, decapitalised housing and transportation infrastructure.

Inevitable Energy Transition

- An efficient policy for the development of the Silesian Voivodeship should take into consideration the **inevitability of the decline of hard coal mining**. Highly industrialised European regions base their economies on efficient manufacturing, and not on the mining sector. The necessary increase in scale and in productivity of Silesian industry in combination with unfavourable demographic trends translates into the constantly growing wage pressure on the mining sector. Therefore, maintaining extraction requires constant improvement of efficiency, which means further reduction of the workforce, gradual shutting down of successive mines, and rapid decline of the economically justified extraction level and the exploitable resources of the hard coal. This process is accelerated by the progressing decline in acceptance on the part of the local communities of further investments in coal extraction under the Silesian communities, which also results from increasing prosperity of the region.
- Historical trends and detailed forecasts of profitability of extraction in Upper Silesian mines indicate that **by 2050 steam coal extraction will disappear from the region**. Only the most efficient coking coal mines have a chance to survive until mid-century, however, they too will have to improve productivity and reduce their workforce significantly. Overall, by 2050, the number of jobs in the sector will fall to below 10 thousand people and it will be seven times lower than currently. Even in the next ten to twenty years, the number of permanent jobs in the mining sector will decrease to approximately 20 thousand. **This prospect cannot be reversed by modern coal extraction technologies** (they will not change the necessity of reducing labour costs), **or the so-called “clean coal technologies”** (they do not provide solutions to the problems with local supply of the hard coal).
- Managing changes in the mining sector means ensuring realistic expectations of all the involved parties. **Clearly communicated prospects of the long-term decline of the industry will ensure the time and resources for the employees, local communities and mining companies to adjust to the changes**. It is also desirable to implement changes to social insurance systems, facilitating the move from mining to other sectors.

-
- The changes in mining must be accompanied by comprehensive modernisation of the whole fuel and energy system. Investments in low-emission technologies for generating electricity and heat, and also major thermal modernisation of buildings in the region, can ensure a positive impulse for the labour market, **which will be comparable to the scale of employees leaving the sector in the next ten to twenty years**. A large reduction of pollution related to low-emission investments will also lead to improved quality of life, making the region significantly more attractive.

Cross-cutting actions: diversified economy, comprehensive revitalisation, efficient public transport

- Increasing the competitiveness of the regional economy requires a **long-term modernisation policy** based on:
 - **expansion and diversification of the local industrial base with highly productive, low-emission sectors**, such as the machinery, electrotechnical, electronic, chemical, or pharmaceutical industries,
 - **development of an advanced services segment**, for instance engineering, IT, R&D, and consulting services,
 - **improvement of competitiveness of higher education institutions and research institutes**, especially in the areas beyond the traditional specialisations connected to mining and conventional energy industries.
- **The problematic areas of Silesian cities require revitalisation, which will ensure the creation of dense, diversified urban fabric connected by efficient public transport.** At the same time, revitalisation should take into consideration the necessity to improve the efficiency of energy use and reduce pollution, as well as ensure adaptation to long term trends (climate change, ageing society). Increasing the funds for development and improvement of the consistency of public transport in the region will enable the integration of the local labour markets, which will help to reduce the differences in the unemployment rate and poverty in neighbouring centres.

Funding Modernisation – All Hands on Deck

- **Funding low-emission modernisation of the region will require legislative changes at the country level, mobilising private funds, and also effective combination of diverse public sources of financing**, in particular:
 - implementation of country-wide regulations for key sectors (energy, buildings, transportation, industry), creating a **stable legal environment for involving private funds in low-emission investments**,
 - assigning **revenue from sale of allowances in the EU ETS system to co-fund low-emission investments**,
 - ensuring **dedicated funds for supporting the transition of coal regions as part of the next European Multiannual Financial Framework as well from domestic sources**.

1. INTRODUCTION

Why the Need for Transition?

The historical mining-industrial centres in Europe, such as the Ruhr, Wallonia, or Yorkshire, started reconstructing their economic models as early the second half of the 20th century. Exhaustion of the easily accessible coal deposits, a large increase in labour costs, damage to the natural environment, increasing competition from abroad, and the technological progress promoting new branches of industry made finding a new basis for the local economy vital for these regions. The next part of this process, taking place in the 21st century, is the result of the EU Member States fulfilling their international climate obligations taken on in Paris in 2015. Pursuant to the special IPCC report (2018), in order to keep the climate change within safe limits, the developed countries have to completely eliminate the net greenhouse gas emissions by the middle of this century. Specifically, this requires far-reaching restructuring of the European energy and industry sectors, with a focus on decreasing the emissions. At the same time, the signatories of the Paris Agreement, as an integral part of climate policy, adopted the principle that this transition would be just. In the case of Upper Silesia it must ensure the creation of good quality jobs for coal industry employees and include all the stakeholders, especially the employees of traditional sectors in the process of change.

This is an especially significant challenge in the case of the most industrialised regions of Europe. Among them, Upper Silesia is a special case. Nowadays, it is the last large hard coal mining area in the European Union. Like other traditional industrial regions of the continent in the past, it has to deal simultaneously with the economic, environmental and social problems that arise as the model for development employed to date ceases being effective.

Why is Further Transition of Upper Silesia Difficult?

One of the key challenges for the region is the declining competitiveness of the mining sector, which until the end of the 20th century was the basis for the local economy. Despite the repeated decreases in the labour force in this industry over the last three decades, there are still over 70 thousand people working in mining of Silesian coal. At the same time, the region has benefited from new sources of economic development. After Poland's accession to the European Union, Silesian Voivodeship made good use of the opportunities offered by incorporation into the delivery chain of the continental industrial centre located along the Rhine valley. This allowed the industrial nature of the region's economy to be maintained. Despite a severe decline in the workforce in the mining and metallurgy sectors: industry is still responsible for one third of the products coming from the Silesian Voivodeship.

THE SIGNATORIES OF THE PARIS AGREEMENT, AS AN INTEGRAL PART OF CLIMATE POLICY, ADOPTED THE PRINCIPLE THAT THIS TRANSITION WOULD BE JUST, ENSURING THE CREATION OF GOOD QUALITY JOBS FOR COAL INDUSTRY EMPLOYEES AND INCLUDING ALL THE STAKEHOLDERS, ESPECIALLY THE EMPLOYEES OF TRADITIONAL SECTORS IN THE PROCESS OF CHANGE

INDUSTRY STILL ACCOUNTS FOR A THIRD OF GDP IN SILESIA VOIVODESHIP

However, this transition has not been completed. Growing labour costs and unfavourable geological conditions mean that the amount of mineable hard coal is shrinking. At the same time, the process of industrialisation, vital to achieve high level of income in the region, is far from complete. Making up the economic distance separating the Silesian Voivodeship from the highly developed industrialised regions in Western Europe, such as southern Germany or the Scandinavian industrial regions, requires maintaining a rapid rate of industrialisation for several decades to come.

Meanwhile, the region is dealing with a series of structural problems: an aging population, decreasing number of inhabitants, a high level of air pollution, damage caused by mining, insufficient local infrastructure, or a high crime rate. Despite significant progress in each of the areas, the quality of life in Silesia is still below that not only in the whole of Europe, but also the rest of Poland.

In this report, we present a synthetic diagnosis of key developmental challenges for the Silesian Voivodeship, emphasising those resulting from specific local conditions and those deriving from the level of advancement of country-wide development processes. We ask what role hard coal will play in the region's future, pointing to the declining trend the mining sector is exhibiting. We examine the limitations connected with maintaining a high level of dependence for power and economic dependence on this black fuel, while identifying the scale of and areas in which modernization is needed.

The decisions made in the next few years will have a huge effect on the future of the voivodeship, which has a chance to become a model for a just transition of a mining region into a modern industrial and commercial region. To make this happen, measures are needed encompassing on one hand responsible restructuring of the traditional core of the local economy, and on the other, the building of new competitive advantages thanks to well-planned investment, social, transportation and environmental policies. The argument we present is that such a policy has to be consistent with the European climate agenda, treating it not as a threat, but as a chance for modernisation, allowing the Silesian Voivodeship to build new potential corresponding to its inhabitants' expectations. The report closes with recommendations for local authorities, central government, and EU institutions.

2. THREE CHALLENGES FOR UPPER SILESIA

2.1. Economic challenge

The main economic challenge for the Silesian Voivodeship looking towards 2050 is no different from that faced by the whole of Poland, and – more broadly – Central Europe. It is achieving a level of development close to the EU average. The best reference points for the region seem to be the industrial, former mining regions of Western Europe, in which restructuring of the economy based on hard coal and metallurgy has already been completed, and in which – to a greater or lesser degree of success – it has been possible to create new competitive advantages. They were based mostly on the manufacturing and modern services. The initial position of the Silesian Voivodeship is relatively good. In 2016, its GDP per capita expressed in purchasing power parity, was half of that of Düsseldorf, more than 70% of the average for the EU, and 85% of the level of the French Nord-Pas-de-Calais region. The same can be said of the level of industrialisation, which exceeds 70% of the European average from the nominal (exchange rate) perspective, and 120% according to purchasing power parity¹. This places the Silesian Voivodeship on a level close to that of Southern Yorkshire in the UK or the Belgian province of Hainaut – regions that, like the economy of Upper Silesia, had economies dominated by hard coal mining and heavy industry.

**THE MAIN CHALLENGE
FACED BY THE SILESIA
VOIVODESHIP UNTIL 2050
IS ACHIEVING THE LEVEL
OF DEVELOPMENT CLOSE
TO THE EU AVERAGE**

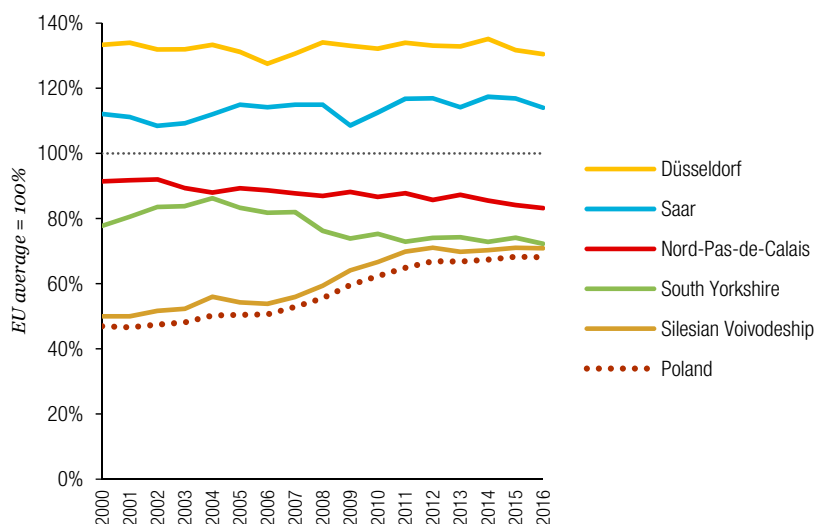


Figure 1. GDP per capita (based on purchasing power parity) in the selected European industrialised regions as a percentage of the EU average, 2000-2016

Source: WiseEuropa based on Eurostat data.

¹ Comparisons according to the purchasing power parity are more favourable than comparisons according to exchange rates. This is derived from the relatively weak exchange rate of PLN in relation to EUR and USD, which makes the nominal difference of the developmental level almost twice as big than the ones resulting from purchasing power of the inhabitants of Poland. In the case of industry, a part of industrial production is exported (which allows for getting higher prices), while a part goes to local market (offering less attractive prices to manufacturers). The relative level of industrialisation of Silesia's economy in relation to the EU is between the two presented values.

THE PERIOD OF TRANSFORMATION WAS IN RELATIVE TERMS THE WORST FOR THE SOSNOWIEC AND BYTOM SUBREGIONS, IN WHICH THE PROBLEM OF RESTRUCTURING HARD COAL MINING AND THE RELATED POOR CONDITION OF THE NATURAL ENVIRONMENT AND CITY INFRASTRUCTURE WERE ESPECIALLY PROMINENT

Even today, the wealthiest parts of the voivodeship: the Katowice and Tychy subregions, have a higher GDP per capita expressed as purchasing power parity than the traditional mining-industrial regions of France and the UK. Nevertheless, a large disproportion is also visible between 8 subregions, and the remaining ones require structural support to reach this level. On the other hand, the examples of the Ruhr or for instance the Saar indicate that successful restructuring of the post-mining areas presents an opportunity to attain a higher level of wealth, even exceeding the European average. This is conditional upon increasing the current level of industrial production and the added value generated in services.

In this context, it is worth noting the uneven development of specific areas of the Silesian Voivodeship in the last thirty years. In the 1990s, the biggest benefits of the economic transition were enjoyed by the Tychy subregion, in which GDP per capita was increasing faster than the average growth in the country. After the global financial crisis of 2008 and the influence it had on the strategy of automotive companies, the Gliwice subregion became the leader in the region. In both subregions, the areas included in the Katowice Special Economic Zone were developing especially rapidly. Since 2000, productivity in this area has increased 2.5 times, resulting at the same time in a significant increase in employment in both the manufacturing and private services sectors. A slightly worse, but still above-average result was achieved by Katowice, which had successes in the field of private services, and the Bielsko-Biała subregion, which at the beginning of the transition had to deal with the problem of restructuring the textile industry. Similarly to

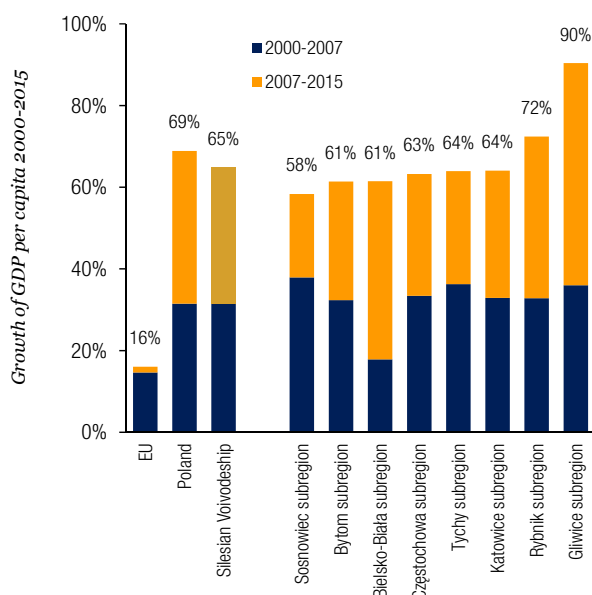


Figure 2. Accumulated growth of GDP per capita in Silesia, Poland, and the European Union in the years 2000-2015

Source: WiseEuropa based on Eurostat data.

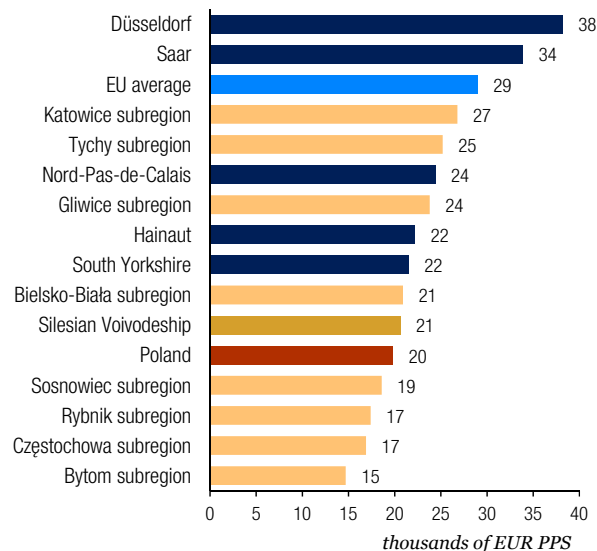


Figure 3. GDP per capita (including purchasing power) in Silesia and in selected European industrial regions, 2015

Source: WiseEuropa based on Eurostat data.

Tychy and Gliwice, in the case of this subregion as well, the development of the automotive industry, as well as the local factories joining the European value chains in close cooperation with the German and Czech industries, was very important.

In relative terms, this period was the worst for the Sosnowiec and Bytom subregions, in which the problem of restructuring hard coal mining and the related poor condition of the natural environment and city infrastructure were especially prominent. They did not attract a sufficient volume of investments capable of counteracting the changes in heavy industry and mining. At the same time, they noted a relatively high (although lower than in Tychy or Gliwice) rate of economic growth and labour productivity, as well as high unemployment and low labour market participation.

The different economic results of individual parts of the Silesian Voivodeship do not mean that the successive governments and local authorities were passive in their approach to the problems of hard coal mining and metallurgy. Laid off employees received severage packages funded by the state budget, and the miners were given a guarantee that a separate, highly subsidised pension system was maintained (see Siedlecka et al. 2017). The severage packages were complemented with a policy of attracting investors, especially the creation of the Katowice Special Economic Zone in 1996. The large influx of new investments to the Zone with the automotive industry at the forefront absorbed the shock – in the whole region – of disappearing jobs in heavy industry and mining to no lesser an extent than the severage packages. Thanks to this, throughout the transition, the Silesian Voivodeship maintained a visibly lower unemployment rate than the country average, which prevented escalation of some social problems, with poverty being the most prevalent. On the other hand, in the voivodeship, after 1990, there was a significant decrease in professional activity – up to 3% below the country level, which could not be fully eliminated even in the period of quick development that followed the accession to the European Union in 2004. This problem touched in particular the regions with initially high employment in the mining sector, in which the quick development of an economic alternative in industry or services did not take place, like Bytom.

Despite the fact that the main burden of restructuring has already been borne, and the mining sector employs just under 4% of the people working in the voivodeship, the special severage programmes realised with the help of the pension system are still maintained. This has had a major impact on the labour competitiveness of the region, which, in relation to other industrial regions of Europe, is characterised – despite the very low unemployment – by a relatively low level of professional activity and employment. In these areas, the Silesian Voivodeship is also inferior to the neighbouring regions directly competing with it for investment capital: the Lower Silesian Voivodeship, Opolskie Voivodeship, and Małopolskie Voivodeship. The reason for this is low employment rate and professional activity of males aged 50+, which is the group making use of the special mining sector pension benefits. In view of the effective elimination of unemployment, the low professional activity in

LARGE INFLUX OF INVESTMENTS LED BY THE AUTOMOTIVE INDUSTRY WAS AS IMPORTANT FOR MITIGATING THE IMPACT OF JOB LOSSES IN MINING AND HEAVY INDUSTRY AS SOCIAL PACKAGES

PROTECTIVE PROGRAMMES RESULTED IN THE RELATIVELY LOW LEVEL OF PROFESSIONAL ACTIVITY AND EMPLOYMENT, ESPECIALLY FOR 50+ MALES, WHICH MIGHT DECREASE THE DYNAMICS OF INDUSTRIALISATION AND MANUFACTURING INVESTMENTS

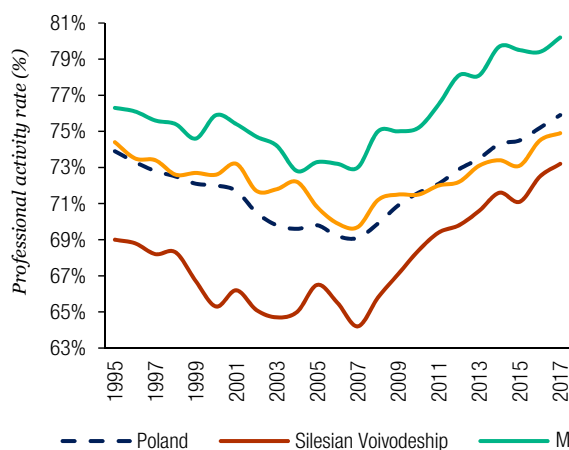


Figure 4. Professional activity rate of people aged 18-59/64 in Poland in years 1995-2017 (%)

Source: WiseEuropa based on Local Data Bank of Central Statistical Office.

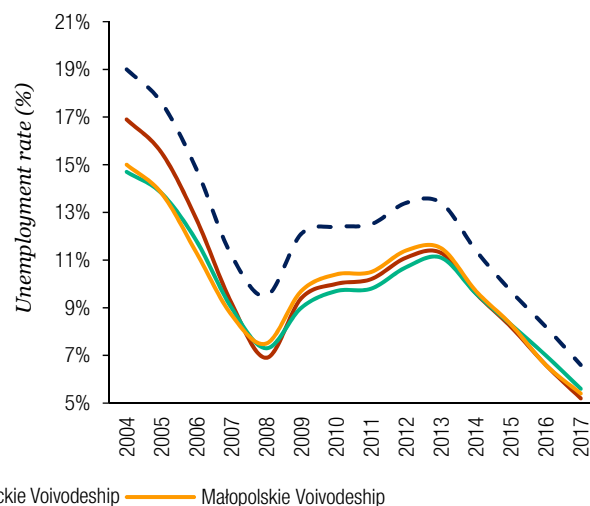


Figure 5. Unemployment rate in the years 2004-2017 (%)

Source: WiseEuropa based on Local Data Bank of Central Statistical Office.

the region may present a threat to its economic growth, especially as it has less reserves in the form of hidden unemployment in the agricultural sector than its neighbours. If this problem is not counteracted, for example by immigration from outside the region, the probable effect will be a decrease in the rate of industrialisation and manufacturing investments, and thus in the competitiveness of the Silesian Voivodeship in comparison to Poland and Europe. In the long-term, this could hamper the process of making up the economic distance in relation to Western Europe and mean that the prosperity level does not go beyond approximately 70%-80% of the EU average.

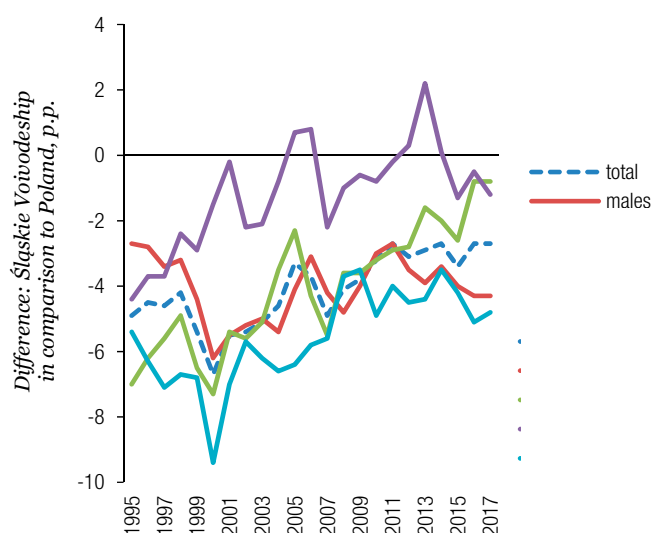


Figure 6. Professional activity for persons of working age, 2017

Source: WiseEuropa based on Local Data Bank of Central Statistical Office.

	Poland	Silesian Voivodeship	Difference
Total	75,9	73,2	-2,7
Males	80	75,7	-4,3
Females	71,2	70,4	-0,8
15-24-year-olds	34,8	33,6	-1,2
50+-year-olds	34,4	29,6	-4,8

Table 1. Professional activity for persons of working age, 2017 (% of general population)

Source: WiseEuropa based on Local Data Bank of Central Statistical Office.

Even assuming that the problems with labour supply are solved or alleviated, for example through immigration, the question arises of the other ways in which the Silesian Voivodeship can develop a competitive advantage. According to the indices collected as part of the European Regional Competitiveness Index, the Silesian Voivodeship has similar strengths and weaknesses as the rest of Poland. Specifically, it has the quality of human capital and institutions close to the country average, so the ability to absorb new technologies is also similar.

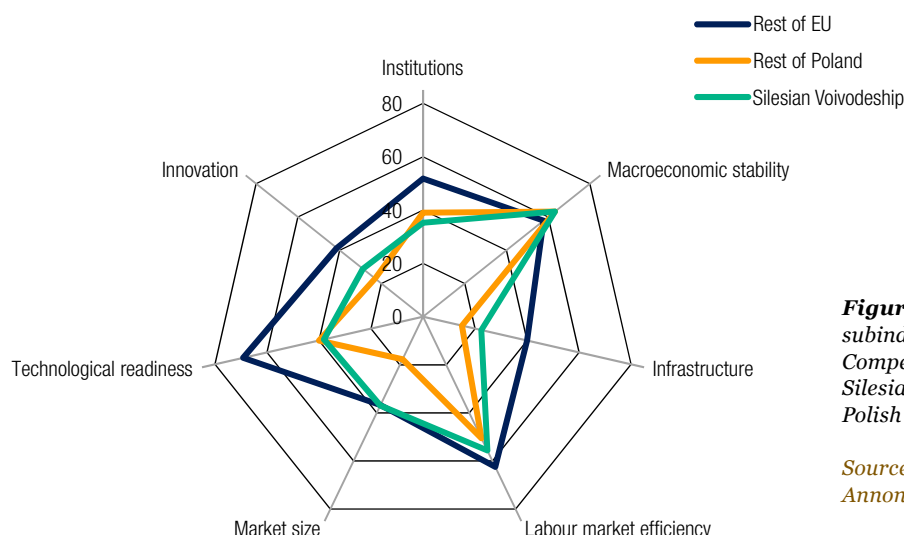


Figure 7. Values of the selected subindices of the European Regional Competitiveness Index 2016 for the Silesian Voivodeship and for other Polish and European regions

Source: WiseEuropa based on Annoni et al. (2017).

Meanwhile, the innovative potential of the region is slightly above the country average, although still lower than the Warsaw and Krakow metropolitan areas. This is the result of relatively high (for Polish conditions) quality of the higher education institutions and research institutes located in the region. On the other hand, this sphere, like the area of transportation infrastructure and the capabilities of public institutions, still requires significant reforms and increased financing. Without it, achieving a level of development close to that of Northern and Western Europe will not be possible in the Silesian Voivodeship, or in the whole of Poland.

Insufficient financing and underdevelopment of higher education and the science sector, along with a strictly manufacturing nature of the industrial companies located in the region, also play a role in the potential for absorption of new technologies, which is clearly lower than in the rest of the EU. Using the main attribute of the Silesian Voivodeship, i.e. a high degree of urbanisation and good geographical location, by itself will allow the region to attract investments driven by an extensive labour market or large consumer base. However, in view of the poor potential for innovation and for absorption of technologies, there are not enough international research and development centres, design-engineering agencies with export potential, as well as companies offering supralocal consulting or IT services in the voivodeship, which

THE INNOVATIVE POTENTIAL OF THE REGION IS SLIGHTLY ABOVE THE COUNTRY AVERAGE, ALTHOUGH STILL LOWER THAN IN THE WARSAW AND KRAKOW METROPOLITAN AREAS

**INCREASING THE
COMPETITIVENESS OF THE
SILESIA VOIVODESHIP
REQUIRES A LONG-TERM
MODERNISATION POLICY
AT BOTH CENTRAL AND
REGIONAL LEVEL**

**ACHIEVING THE EU AVERAGE
LEVEL OF PROSPERITY IN
THE SILESIA VOIVODESHIP
REQUIRES MORE THAN A
THREE-FOLD INCREASE OF
THE VALUE OF INDUSTRIAL
GOODS AND MARKET
SERVICES GENERATED IN
THE REGION**

in the long term may hamper growth in work productivity and the level of prosperity in the region.

Increasing the competitiveness of the Silesian Voivodeship requires readiness to follow a long-term modernisation policy – on the part of both the central and regional authorities. The advantages from the first years after Poland's accession to the European Union, for instance in the form of good East-West transport connections thanks to road investments, which in a short time connected the Czech Republic and Western Poland with German industry, are not enough. The North-South route remains underfunded transport-wise (both with regard to roads and railways), i.e. the connections of the region with the Czech Republic through the Moravian Gate and the Silesia-Central Poland, Baltic Sea and Silesia, Greater Poland and Western Pomerania routes. Once these gaps are filled, countrywide road and railway infrastructure modernisation programmes will enhance the geographical advantages of the region. These changes, however, need to be accompanied by reforms that are broader than just infrastructure, directed at increasing the scientific potential of the region and significant improvement of the international status of the local higher education and scientific institutions, including in the spheres not connected to the mining sector.

This is due to the need for diversification of the industrial structure of Silesian economy – both its industrial core and the increasingly economically important service sector. To achieve a level of prosperity close to the EU average by 2050, the whole Silesian Voivodeship needs to increase the industry and market services manufacturing, in exchange rate conversion, by 3.5 times. This means maintaining the mean rate of economic growth at 4% annually for the next three decades, with approximately 1.0-1.5% of this value being gradual appreciation of PLN in relation to EUR, and approximately 2.5-3.0% being the increase in volume of production measured in purchasing power parity. Assuming that the general industrial orientation of the region continues, this means increasing the value of industrial production per capita to approximately EUR 10-14 thousand and the value generated in market services in the range of approximately EUR 14-18 thousand per capita by 2050 (Fig. 8).

This target is currently achieved by the most developed regions of the EU, however, they too, gradually – at approximately 1.2-1.3% annually – are increasing the value and productivity of their own economies. This means that although the Silesian Voivodeship's development goals for 2050 should assume exceeding the average European level of industrialisation, up until this time the region will probably remain behind industrial and commercial centres such as Tübingen, Karlsruhe, Central Franconia, Upper Palatinate, Upper Austria, or Western Sweden. The high level of development of these regions – and the whole of Europe – is based on manufacturing and the service sector coupled to it. It will be the complex manufacturing, and not the energy or mining sectors, that enable a high share of industry in the added value to be reached, and demand to be created for high-quality engineering, design, research and development, or consulting services. There are only a few oil and gas mining regions (Groningen, North-Eastern Scotland), and

COMPETITIVENESS

**Increasing the competitiveness
of the Silesian Voivodeship requires
a long-term modernisation policy
at both central and regional level**





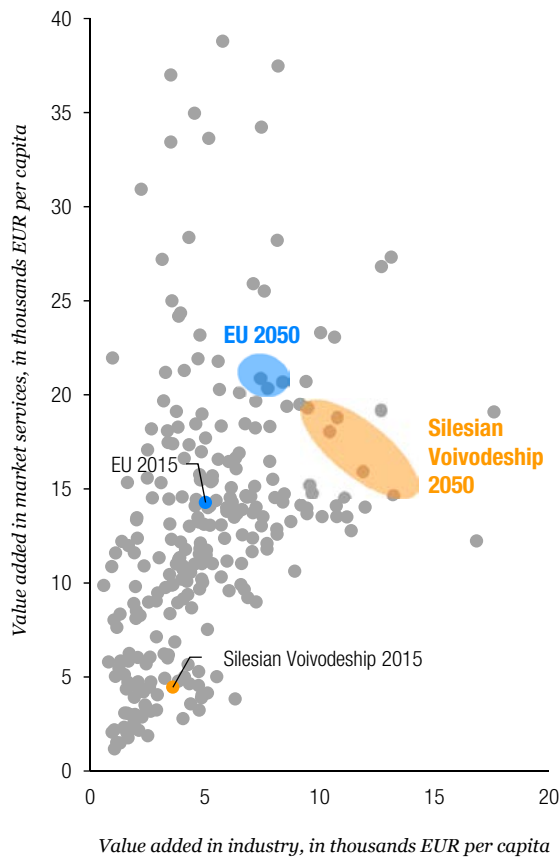


Figure 8. Value added in industry and market services in European regions in 2015, forecast for the EU average until 2050, and values for the Silesian Voivodeship ensuring the EU average is reached in 2050.

Source: WiseEuropa based on Eurostat data.

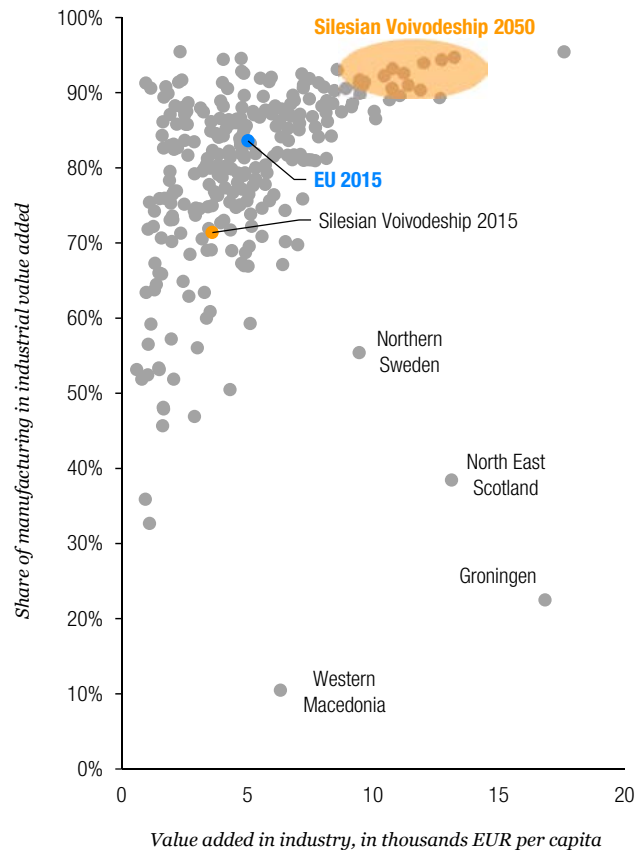


Figure 9. Value added in industry in European regions in 2015 and the significance of manufacturing in relation to other sectors (including the mining and energy sectors)

Source: WiseEuropa based on Eurostat data.

also the sparsely inhabited specialist of metal ore mining areas (Northern Sweden) to which this rule does not apply. Only Western Macedonia, with its small population, reached a high level of industrialisation based on lignite deposits, but this does not translate directly into the general level of prosperity due to the underdevelopment of the service sector, and does not guarantee long-term stability of development. It is no wonder therefore that currently in Western Macedonia there is an intensive debate going on around the possibility of finding new competitive advantages in order to avoid economic collapse in the event of the expected shutdown of lignite mining in the region over the coming decades.

**IS BE THE COMPLEX
MANUFACTURING, AND NOT
THE ENERGY OR MINING
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BE REACHED, AND DEMAND
TO BE CREATED FOR HIGH-
QUALITY ENGINEERING,
DESIGN, RESEARCH
AND DEVELOPMENT,
OR CONSULTING SERVICES**

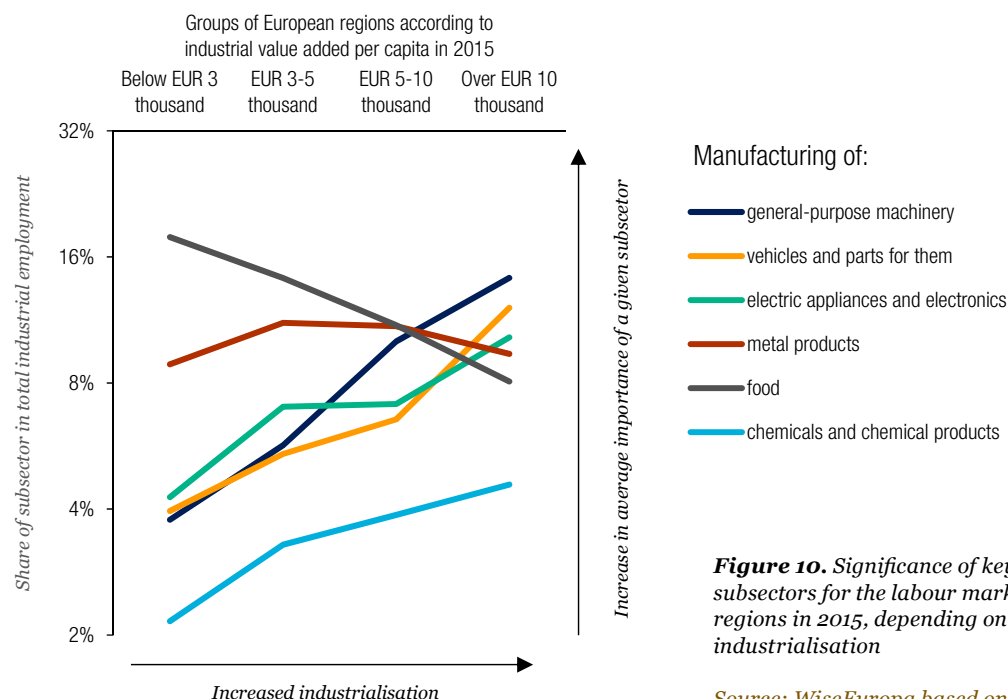


Figure 10. Significance of key manufacturing subsectors for the labour market in European regions in 2015, depending on the degree of their industrialisation

Source: WiseEuropa based on Eurostat data.

DIVERSIFICATION OF THE SILESIAN ECONOMY MEANS CHANGE TO THE THE INDUSTRY STRUCTURE OF INDUSTRY AND DEVELOPING NEW TYPES OF EXPORT-ORIENTED SERVICES

Diversification of the Silesian economy has to be based on changes in the way industry is structured in the sector and on developing new types of export-oriented services. This allows a high level of production, high efficiency, and a competitive advantage to be achieved, making it possible to gain high unit prices in the service sector at the same time. Therefore, in industrial regions, sectors centred around meeting the local needs, such as the food industry, play a relatively small role compared to that of the companies that fall within the Europe-wide industrial commons and thus create a comparative advantage of the European Union on the industrial map of the world: manufacture of machinery, mechanical vehicles, chemical products and medicines. For this reason, within the next two or three decades, it will be especially important for the Silesian Voivodeship to maintain and strengthen its competences in specific fields. This includes actions related to the automotive industry (consistent with the technological changes that will inevitably affect this field, mostly electric drives), and which, at the same time, enable development of local export-oriented companies in the machinery, chemical, electronic or pharmaceutical industries, in symbiosis with the companies offering advanced B2B and B2C services.

Achieving these goals will require local authorities and central agencies to take up activities at the point of contact with the investors representing industries (chemicals, pharmacy, electronics, machinery production, etc.) and types of activities (R&D, consulting, IT services, design-engineering centres, etc.) that so far have been under-represented in the region. Their expectations will differ from both the expectations of the companies of the coal-steel complex, and of the product-wise less complex branches of the economy (food, metal industries,

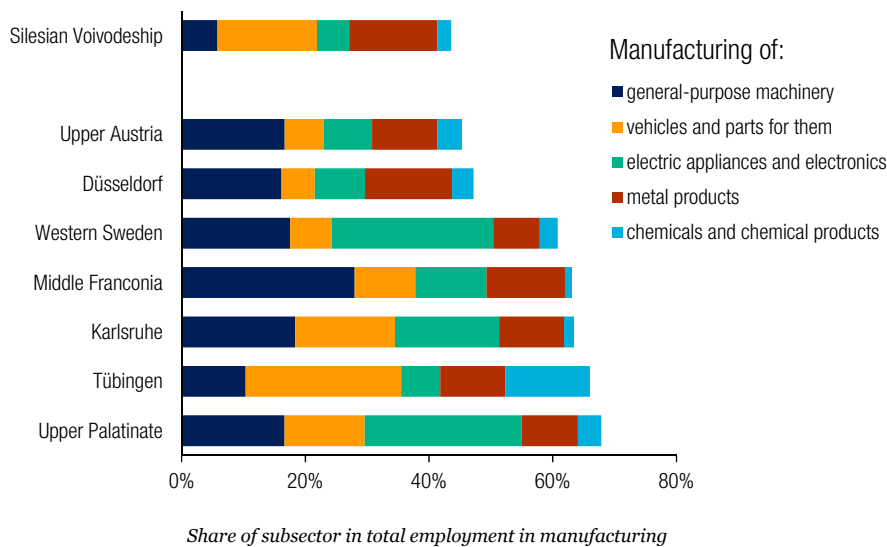


Figure 11. Share of key manufacturing subsectors in the total number of people employed in manufacturing in selected European regions in 2015

Source: WiseEuropa based on Eurostat data.

shared services centres, etc.). This means they will require preparation of different and more subtle investment incentives than before. Therefore, on the economic plane, the development policy of the Silesian Voivodeship must go beyond the sphere of infrastructure, expanding to the area of scientific policy, innovation policy, and also social-environmental policies guaranteeing the standard of life attractive to specialists sought after in the more advanced sectors of the economy.

THE DEVELOPMENT POLICY OF THE SILESIA VOIVODESHIP NEEDS TO MOVE BEYOND THE SPHERE OF INFRASTRUCTURE, EXPANDING TO THE AREA OF SCIENTIFIC POLICY, INNOVATION POLICY, AND ALSO SOCIAL-ENVIRONMENTAL POLICIES



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Box 1. NEW INDUSTRIALISATION OF UPPER SILESIA AFTER 1989

The current level of prosperity of the Silesian Voivodeship is the result of the processes that took place in the region's economy in the years 1990-2017. In this period, the voivodeship underwent extensive internal restructuring, dealing both with the necessity of reducing the workforce and the redundant manufacturing capability in the industries in which marketisation of the economy changed the structure of economic stimuli the most, and with the necessity of building new competitive advantages compatible with a uniting Europe.

In the 1990s, the decreased demand for coal from energy users, the appearance of higher quality foreign competition in the steel market, and the departure of the textile industry to Asia, were a big shock to the local economy. The workforce in industry and agriculture was decreasing, and increasing in private services. The reduction of the number of jobs could be seen mainly in the mining sector. In the years 1990-1999, 230 thousand people left the industry, i.e. half of the people working in it in 1989, and the hard coal extraction decreased by one third (45 million tonnes).

During the global energy commodities boom (2000-2007), the level of employment in the sector stabilised again, only to fall again in the later years with the next wave of restructuring forced

upon it by the low productivity of the industry and large financial losses. In the years 2007-2017, the number of people employed in the mining sector decreased again by another two fifths.

Next to mining, the industry sectors influenced by in-depth restructuring after 1990 were heavy industry (mainly metallurgy) and the energy industry. In both industries, there were several waves of major reductions in the workforce, and further declines are very probable due to the necessity keep up with the general market trends of increased productivity.

The changes also affected light industry, including the textile industry traditionally located in Bielsko-Biala, which was exposed to competition with Asian manufacturers. These processes are being counterbalanced by the fast development of the other manufacturing subsectorss. Production grew in the industries connected with the automotive industry (manufacturing vehicles, metal and rubber products) and electromechanical industry. Therefore, industry developed mostly in the spheres that were the fastest in integrating with the European industrial centre – the so-called Europe Factory stretching from the Atlantic, through the Rhine valley and Saxony, to the Czech Republic and Western Poland (see Bukowski and Śniegocki 2017).

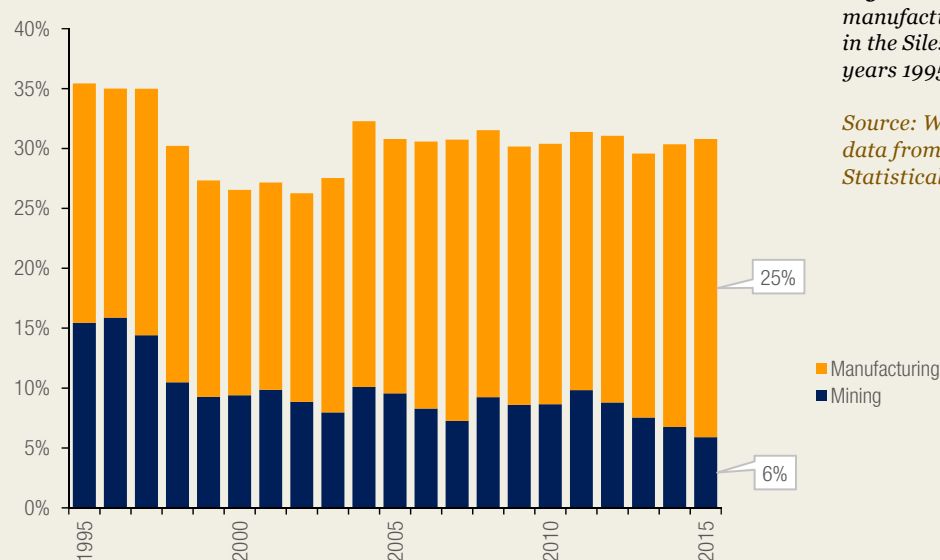


Figure 12. Share of mining and manufacturing in gross added value in the Silesian Voivodeship in the years 1995-2015 (%)

Source: WiseEuropa based on the data from Local Data Bank of Central Statistical Office.

Box 2. INCLUSION OF CENTRAL EUROPE IN THE EUROPEAN INDUSTRIAL CENTRE AFTER 1989

Despite the restructuring challenges, the Silesian Voivodeship has the advantage of a favourable geographical location, distinguishing it from some less centrally located heavy industry centres, such as Glamorgan County in Wales. The region is an extension of the European industrial centre extending from the Belgian and Dutch coasts of the Atlantic, along the valley of the Rhine, through Saxony, to the Czech Republic and Western Poland. The areas located along this axis are characterised by an above-average level of employment in industry (see figures 1 and 2), high population density and population, and high level of urbanisation, and, consequently, also low unemployment and a relatively high GDP per capita. Due to historical conditions, specifically the Iron Curtain, which separated East-German, Czech and Polish industry from Western Europe for half a century, there is a visible developmental gradient extending from the West to the East along this axis. The areas of Saxony, the Czech Republic, and for example Western Poland are – despite similar workforce levels in industry – less developed than the vicinities of Cologne, Düsseldorf, or Detmold. However, since the reunification of Germany, transitions in the Czech Republic and Poland, and the accession of these two countries to the European Union, the manufacturing growth has been very high in their case. Thanks to the change of industrial structure and significantly

more efficient production, even now the region of Leipzig, Chemnitz and the Moravian-Silesian Region generate more added value per capita than the EU average, and the Silesian and Lower Silesian Voivodeships are quickly approaching this level.

At the beginning of the transition, the Polish and Czech industrial regions had to deal with the negative legacy of socialist industrialisation: natural environment devastation, low productivity of work, high material-intensity of production, and a small degree of its processing. However, thanks to the close proximity of the highly industrialised valley of the Rhine, the restructuring of heavy industry and mining was easier than in the less centrally located regions of England or Spain. Apart from Lower Silesia and Eastern Saxony, Moravia and Upper Silesia have become the main destination of relocated parts of the production chain, allowing them to relatively easily fill in the developmental gap created by heavy industry and mining not being able to withstand the confrontation with the market economy. At the same time, further diversification of their own production base, including developing in their areas sectors and activities connected to high productivity of work, high-quality workforce, and salaries attractive to specialists with the highest level of human capital and know-how is still a challenge.

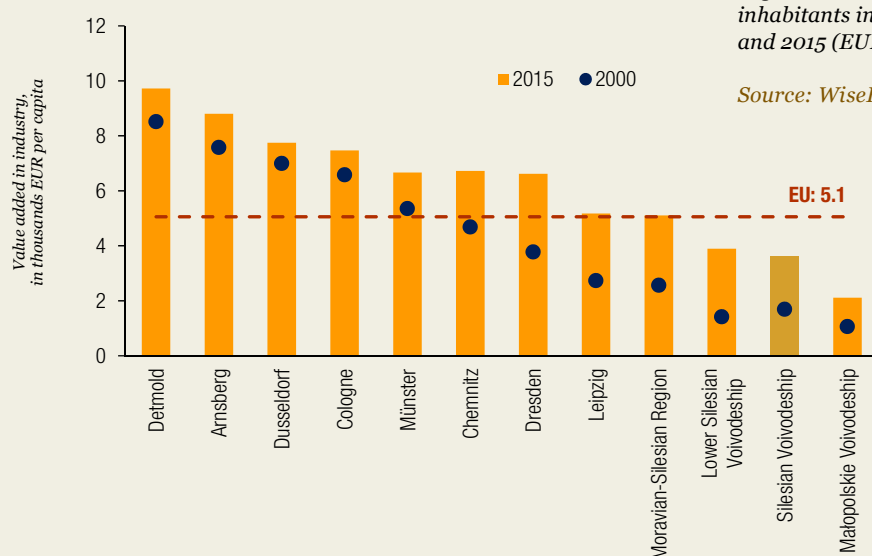


Figure 13. Added value in industry per 1,000 inhabitants in the EU industrial regions in 2000 and 2015 (EUR, constant prices from 2015)

Source: WiseEuropa based on Eurostat data.

2.2. Challenge of improving quality of life

A COMPLEX PICTURE
OF THE QUALITY OF LIFE
IN EUROPE IS PRESENTED
BY THE SOCIAL PROGRESS
INDEX (SPI)

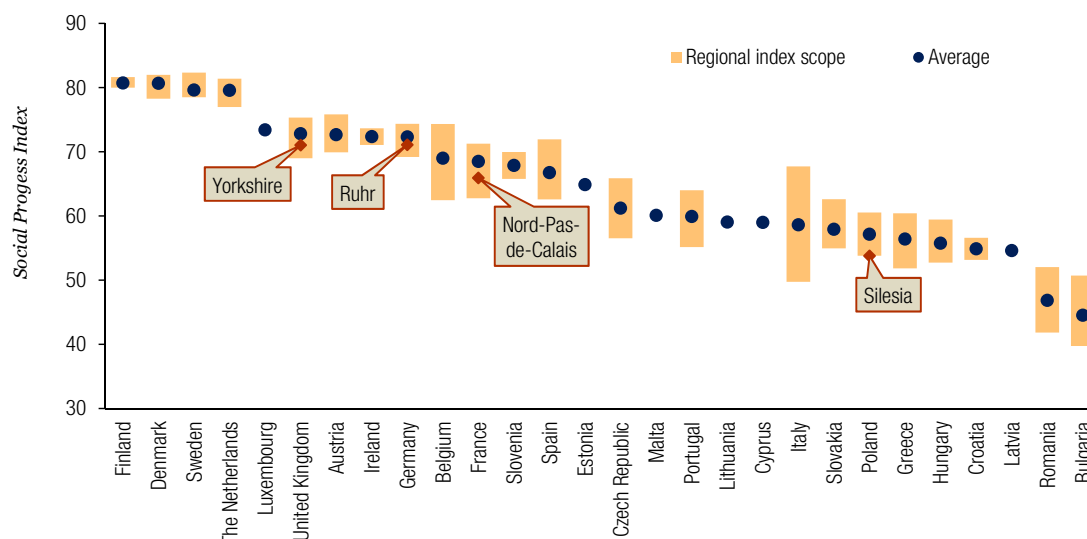
The purely macroeconomic description is an approximate representation of the quality of life in the region. From the perspective of inhabitants, the attractiveness of specific areas in the country is defined, however, not only by the level of GDP per capita, remuneration, or the unemployment rate, but also access to education, sense of security, housing conditions and the quality of the natural environment. Therefore, industrialisation and diversification of the local economy are an important, but not the only element of development, determining competitiveness of the region in Poland and in the continent. Consequently it is also determining the demographic changes and economic and migration processes taking place in a given area. A complex picture of the quality of life in Europe is presented by the Social Progress Index (SPI) developed by the European Commission. This encompasses such factors as access to the key categories of goods and services, public safety, average state of health, the quality of the natural environment, or the scope of rights and liberties they are entitled to².

The spread of the index values in individual countries and between them shows that, apart from a few exceptions (Italy, Belgium), quality of life in the region is largely determined by the level of development of the country in question. The small differences between the results of regions within individual countries are the results of interdependence between economic development and social development on one hand, and on the other of generally significant capabilities of the social, educational and health policies to redistribute the generated GDP among the poorer and wealthier regions, and so balance the quality of life between different parts of a given country. Among the EU Member States, the highest mean value of the index is achieved by the Nordic countries – Finland (81), Denmark (81), and Sweden (80), and the lowest – by the countries of Central and Eastern Europe (Romania – 47; Bulgaria – 45). Poland is in the lower half of the ranking, with other countries of

Figure 14. Regional values of Social Progress Index in the EU countries in 2016.

Source: WiseEuropa based on the data from DG REGIO.

² Most of the partial indices making up the SPI come from the statistics of Eurostat and national statistical agencies, including the Polish Central Statistical Office, which, in some cases (e.g. trust in public institutions), are complemented by the results of dedicated surveys.



Central and Eastern Europe, but also with Italy and Greece, falling behind the Czech Republic, Estonia and Slovenia on one hand, but ahead for example of Hungary, Latvia, Romania, or Bulgaria on the other.

In relation to the Silesian Voivodeship, this means that the lower quality of life in the region in comparison to Western Europe is less due to the specific nature of the Silesian Voivodeship than due to the level of prosperity of the whole country and the type of public policy in Poland. At the same time, however, the relative value of the SPI in the region compared to the whole of Poland is visibly lower than the relative level of its economic development in comparison to the rest of the country. Whereas in terms of GDP per capita Silesian Voivodeship is 209th in Europe (out of 272 regions), in relation to quality of life it is only 252nd. **Therefore, the relatively low quality of life in Silesian Voivodeship is less due to problems that are common to the whole country than due to the issues specific to the voivodeship, which in this respect falls behind many of the significantly poorer regions of the country.**

The reasons for the lower quality of life in the Silesian Voivodeship are the structural problems related to the incomplete or improperly performed transition into a post-mining economy in the 20th century. At the same time, the high positions in this ranking held currently by Yorkshire, the Ruhr, or Nord-Pas-de-Calais indicate that former mining regions can effectively deal with this legacy. Today, it is the exceptionally poor quality of the natural environment that is mainly responsible for the low rating of the Silesian Voivodeship (last place among the 272

THE QUALITY OF LIFE IN THE REGION IS VISIBLY LOWER THAN ACCORDING TO THE ECONOMIC DEVELOPMENT INDICES, WHICH IS MOSTLY DUE TO THE VERY HIGH LEVEL OF AIR POLLUTION

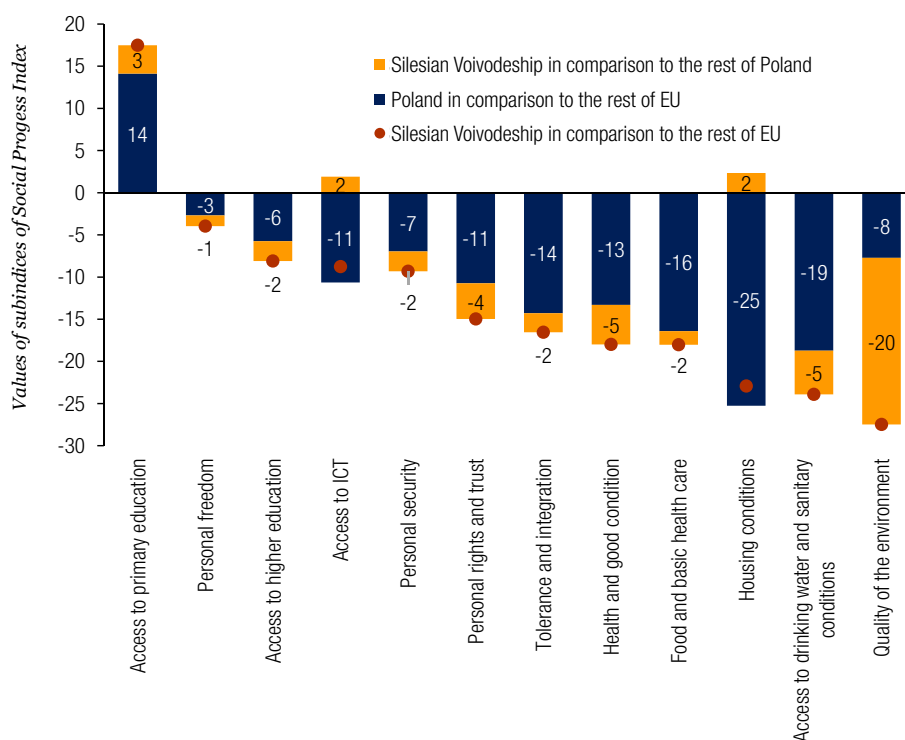


Figure 15. Values of SPI subindices: differences between the Silesian Voivodeship, the rest of Poland and the rest of the EU in 2016

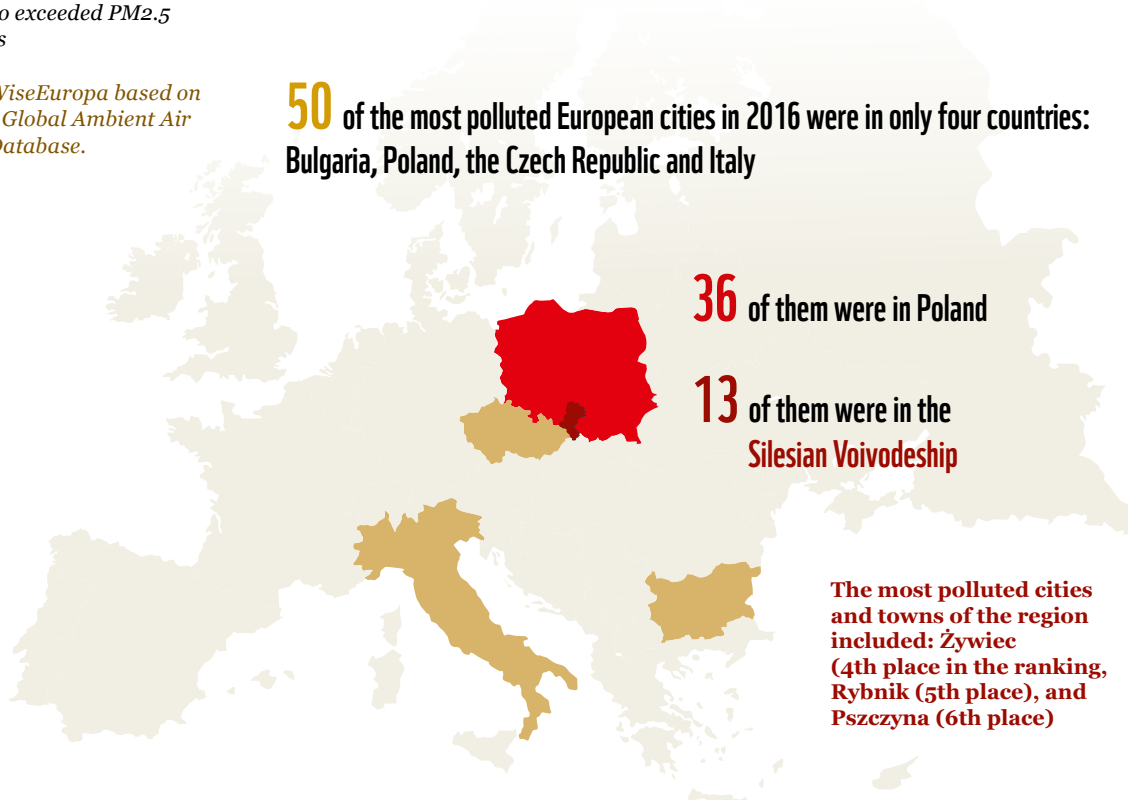
Source: WiseEuropa based on the data from DG REGIO.

**SOLID FUELS USED FOR
HEATING PURPOSES IN
HOUSEHOLDS ARE THE MAIN
SOURCE OF AIR POLLUTION**

analysed European regions), including in particular the high level of air pollution, which affects the health of the region's inhabitants. This result is also confirmed in other sources: according to the statistics of the World Health Organisation, as many as 36 out of 50 of the European cities most polluted with PM10 and PM2.5 particles are in Poland. Among them, 13 are in the Silesian Voivodeship – they are both small towns like Żywiec or Rybnik, and the biggest cities of the region – Bielsko-Biała, Sosnowiec, and Katowice, for instance. According to data provided by the Voivodeship Environment Inspectorate, in 2016, in all the five zones of the Silesian Voivodeship, the admissible levels of PM10 particles were exceeded. This significantly increases the risk of developing circulation and respiratory problems in the region.

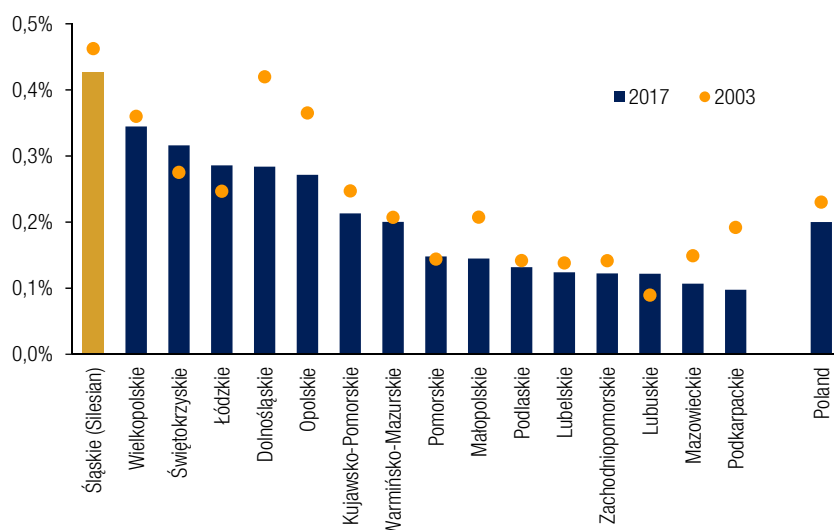
Diagram 1. The most polluted cities in Europe in relation to exceeded PM2.5 standards

Source: WiseEuropa based on the WHO Global Ambient Air Quality Database.



The sources of the pollution are mostly solid fuels used for heating buildings, but also other branches of the economy, such as heavy industry, the mining industry, energy industry and transport. The quality of air in the region is affected by all the solid fuels used for individual heating of buildings, even the high-quality ones. They are not purified, their fumes are not filtered, and are emitted at low altitudes, so they are a major factor in the significant air pollution in the densely populated areas. Therefore, to solve the problem of poor air quality in the Silesian cities, it is not enough to increase the average quality of solid fuels. It is necessary to popularise the centralised heating systems, gas heating, and also electric heating in combination with significant increase of the heating efficiency of buildings in Silesia.

It is also worth noting the environmental problems not included in the SPI. The long-term industrial activity and the high intensity of economic exploitation of the Silesian Voivodeship's resources are responsible for it being the region with the most deteriorated and devastated areas surface-wise in the country. Within the last ten to twenty years there has been an improvement. However, it is much slower than in the case of other voivodeships in Southern Poland (Opolskie, Małopolskie, Lower Silesian).



THE LONG-TERM INDUSTRIAL ACTIVITY AND THE HIGH INTENSITY OF ECONOMIC EXPLOITATION OF THE SILESIAN VOIVODESHIP'S RESOURCES IS RESPONSIBLE FOR IT BEING THE REGION WITH THE MOST DETERIORATED AND DEVASTATED AREAS SURFACE-WISE IN THE COUNTRY

Figure 16. Deteriorated and devastated areas in voivodeships (as a percentage of total areas) in the years 2003 and 2017

Source: WiseEuropa based on Local Data Bank of Central Statistical Office.

A factor inhibiting the process of redeveloping post-industrial areas is the often unclear legal status of the real estates. Areas in city centres are also subject to conservation regulations. Additional costs and administrative obstacles discourage potential private investors, and the resources of local authorities do not allow post-industrial areas to be sufficiently redeveloped, especially if this involves purifying contaminated soil and restoring ecological balance (see Bolek 2016). At the same time, the extensive mining damage, wherever mines are operated or used to be operated, have a negative effect on attractiveness with regard to commerce and quality of life of many areas in the voivodeship – they raise the infrastructure maintenance costs, decrease the quality of life of inhabitants, and reduce investors' interest in completing project in the area in question.

Analysis of the Social Progress Index is complemented by analysis of immaterial factors, making up the subjective assessment of the quality of life. A comprehensive picture of how it is perceived by the inhabitants of Upper Silesia is provided by successive editions of the *Social Diagnosis* (Tab. 2)³.

THE EXTENSIVE MINING DAMAGE IN MANY AREAS IN THE VOIVODESHIP HAS A NEGATIVE EFFECT ON THE ATTRACTIVENESS OF THE AREA WITH REGARD TO COMMERCE AND QUALITY OF LIFE

³ The *Social Diagnosis research* study focuses on collecting information regarding the conditions and the quality of life of Poles, based on their own reports. The information is collected via questionnaires filled out by household members included in the study. In years 2000-2015, eight editions of the study were performed.

According to the results of the last study from 2015, the Silesian Voivodeship was 6th among 16 voivodeships with regard to the quality of life. Since 2009, it has consistently been placed in the ranking behind the Pomorskie Voivodeship, Mazowieckie Voivodeship, Małopolskie Voivodeship and Wielkopolskie Voivodeship, which held the top positions. Silesian Voivodeship was ranked highest in relation to psychological well-being and civilisational level of the inhabitants. It was given the lowest score for social well-being (10th place) and freedom from pathological problems (13th place), for which the result was especially poor in the Katowice and Bytom subregions, but also in the Tychy and Bielsko-Biała subregions.

Thus, the aforementioned low level of poverty in Silesia does not automatically translate into a lack of social problems. On the contrary – they appear with particular intensity in the areas affected by restructuring of the traditional branches of industry, regardless of whether this process is going well economically.

Table 2. Quality of life in the Silesian Voivodeship compared with the rest of the country according to Social Diagnosis 2015

Source: WiseEuropa based on the data from Social Diagnosis 2015.

Quality of life	X	Silesian Voivodeship in the ranking of 16 voivodeships	Description
Psychological well-being	4		sense of happiness, assessment of whole life so far, intensified symptoms of psychological depression, assessment of the past year
Civilisational level	5		level of education, having and using consumer electronics and ICT, active knowledge of foreign languages, driver's licence
Financial well-being	6		income, number of goods and appliances in the household
Social capital	6		activities for the local community, participation in elections and non-obligatory meetings, positive attitude towards democracy, membership in organisations and holding a function in them, conviction that most people can be trusted
Physical well-being	6		intensification of somatic symptoms, serious illness in the past year, level of disability, intensification of stress in relation to health
Freedom from life stress	8		stress regarding experiences in: finances, work, contact with state agencies, bringing up children, marital relationship, ecology
Social well-being	10		no sense of alienation, sense of being loved and respected, number of friends
Freedom from pathological problems	13		pathological problems include alcohol and drug abuse, smoking, visits to a psychiatrist or a psychologist, being a perpetrator or a victim of a crime

This does not mean that successful economic restructuring is not important for the social aspects of quality of life. **According to Social Diagnosis, the most economically developed subregions of the Silesian Voivodeship, the Tychy and Gliwice subregions, are at the same time among the top five subregions in Poland in terms of quality of life.** On the other hand, the Częstochowa subregion was among the areas with the lowest score, falling behind areas affected by restructuring such as the Bytom subregion.

Also, the statistical data show a clear correlation between the level of unemployment and the risk of poverty in a given area. The city where the problems of unemployment and poverty in the region is most intense is Bytom. This is also a city in which the most inhabitants use community social services, whereas in Upper Silesia there are centres (Siemianowice and Chorzów) with a similar range of services and a significantly lower level of unemployment. An example of a prosperous centre with above-average exclusion problems is also Katowice.

The cities that are best at dealing with social problems using strictly economic tools are Bielsko-Biała, Tychy and the nearby Bieruńsko-Łędziński (formerly the Tyski) Poviát, i.e. the centres that do not have to bear the large burden of post-mining structural problems. To sum up, although economic development facilitates an increase in the level of social well-being in a given area, and this is hampered where there is no economic development, the quality of social policy is also significant. This is characteristic not only of the Silesian Voivodeship: comparable differences can be observed for example between the Łódź and Piotrków subregions, or between the eastern and western Warsaw subregions.

**THE STATISTICS SHOW
A CLEAR CORRELATION
BETWEEN THE LEVEL
OF UNEMPLOYMENT
AND THE RISK OF POVERTY
IN A GIVEN AREA**

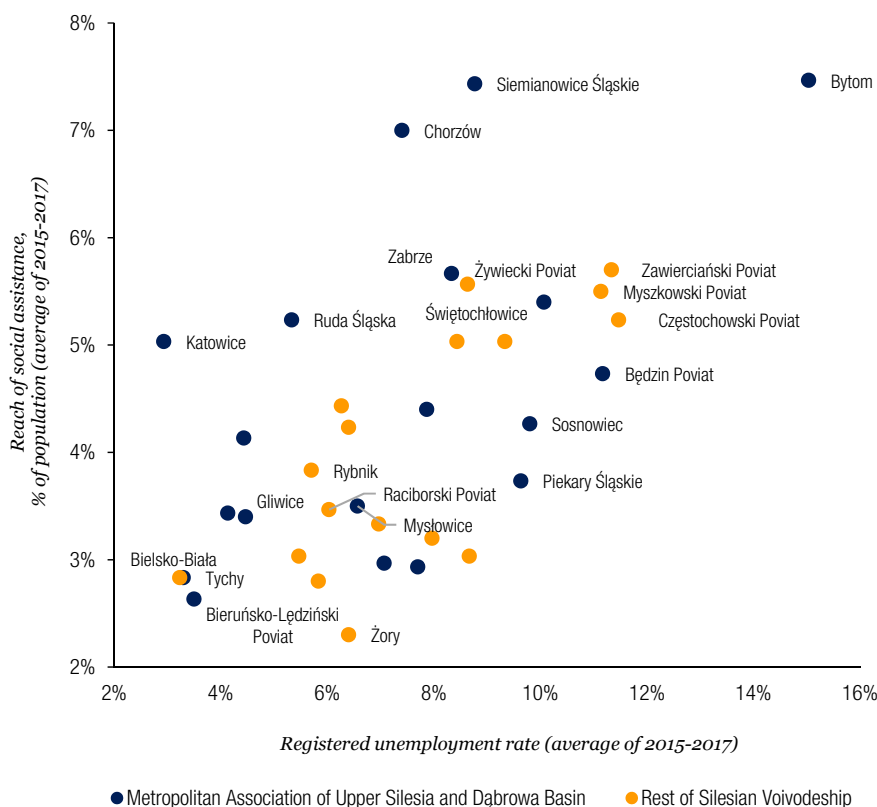


Figure 17. The differences in the level of unemployment and the reach of social assistance in cities and poviats in the Silesian Voivodeship, 2015-2017

Source: WiseEuropa based on the data from Local Data Bank of Central Statistical Office.

Box 3. LOW LEVEL OF POVERTY IN THE SILESIA VOIVODESHIP

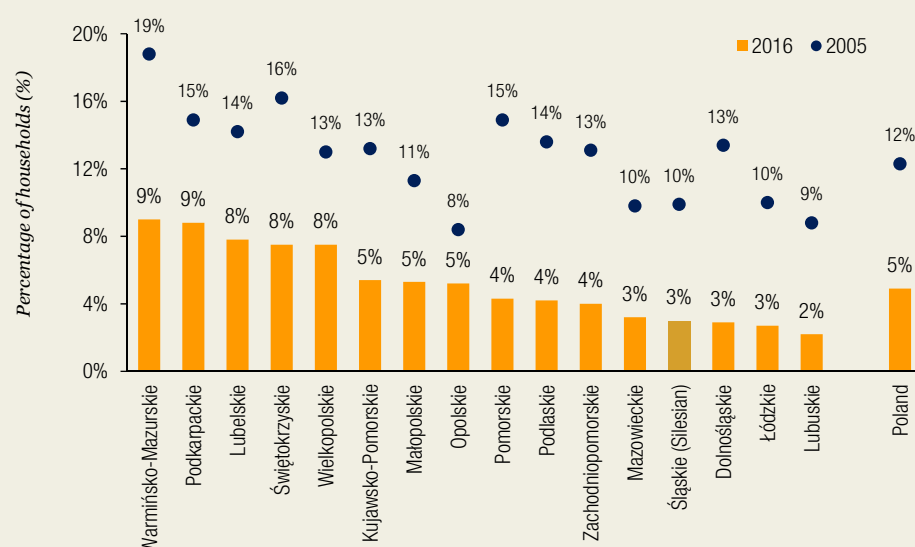
The Silesian Voivodeship is one of the regions in Poland that have the least problems with poverty – both absolute and relative. Despite the intensive restructuring processes, from 1990 onwards the voivodeship never experienced large-scale unemployment, as the quick development of the manufacturing and services helped at least one person in a household to find a job even in the most difficult periods in the employment market (1990-1993 and 2001-2003). The Silesian Voivodeship is one of the most urbanised, and, at the same time, one of the regions in Poland with the best internal transport connections. A person looking for employment is not limited to the local job market, which increases their chances of finding a job. The threat of poverty among the most vulne-

rable groups, i.e. children and the elderly, is low in the Silesian Voivodeship, in which one factor, apart from a high level of urbanisation and industrialisation, is the model of social transfers – above-average benefits are offered not only to people working in mining and heavy industry, but also to their families. This reduces poverty and unemployment, but it also raises the level of professional inactivity in the 15-34 and 55+ age groups.

As a result, in the Silesian Voivodeship, only 3% of households are at risk of extreme poverty, which makes it one of the least affected regions in the country. For comparison, currently, in Eastern Poland, almost 10% of inhabitants are at risk of extreme poverty

Figure 18. Percentage of households at risk of extreme poverty in 2005 and 2016 (%)

Source: WiseEuropa based on the data from Local Data Bank of Central Statistical Office.



THE SILESIA VOIVODESHIP IS ONE OF THE REGIONS IN POLAND THAT HAVE THE LEAST PROBLEMS WITH POVERTY - BOTH ABSOLUTE AND RELATIVE



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2.3. Demographic challenge

The Silesian Voivodeship is inhabited by approximately 4.5 million people, i.e. one eighth of the population of Poland. The population is evenly distributed between the mining and non-mining municipalities, with approximately half of them living in the areas historically connected with hard coal mining. Almost one third of the population lives in the areas with operational mines.

In the scale of the whole voivodeship, only the Bielsko-Biała and Częstochowa subregions do not have any historical ties to mining, although, in the past, they had industries dealing with the restructuring problem functioning within their boundaries: the textile and metallurgical industries. At the same time, the subregions with a productivity level and GDP per capita lower than the country average (the Sosnowiec, Rybnik, Częstochowa, and Bytom subregions) are inhabited by approximately half of the voivodeship's population. Therefore, regional development will depend either on maintaining the hitherto interregional growth structure and inducing migration within the Silesian Voivodeship, or on the region's capability to perform internal restructuring, so inducing quick development also of the areas that have been participating in it to a lesser degree. Slightly different opportunities and risks are connected to both of these scenarios. The former requires maintaining quick growth of labour productivity in the Upper-Silesian development centres,

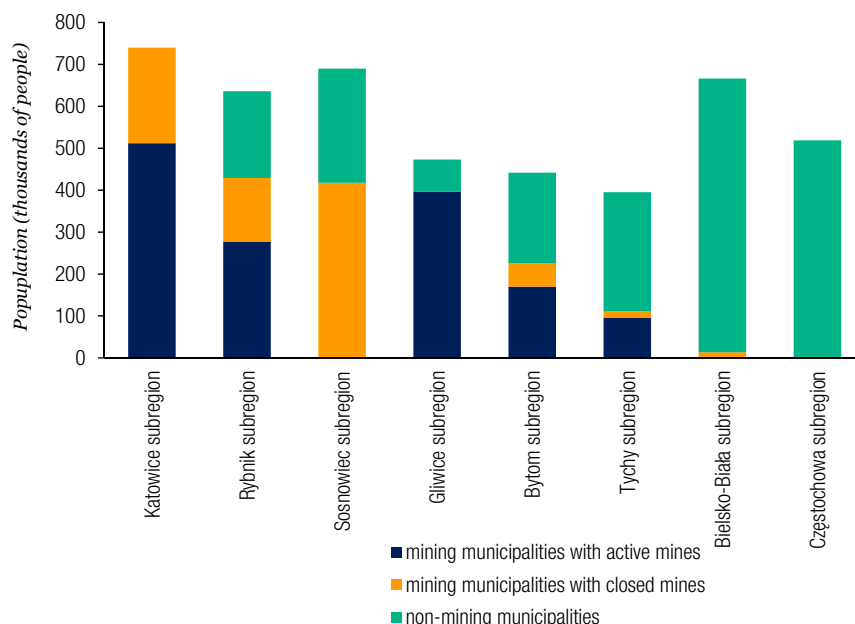
**THE SILESIA VOIVODESHIP
IS INHABITED BY APPROXIMATELY 4.5 MILLION
PEOPLE, I.E. ONE EIGHTH
OF THE POPULATION
OF POLAND.**

even if they are close to the average European level of industrialisation and GDP per capita. At the same time, these regions would have to start attracting a large number of new inhabitants or employees commuting from less-developed areas, which requires major changes in housing and transportation infrastructures of the whole region. In the latter scenario, the less-developed areas of the Silesian Voivodeship would have to be made more attractive investment-wise, and draw more investment in production to the area than before.

Figure 19. Number of people living in mining and non-mining municipalities in Silesian subregions (NUTS 3 statistical areas) in 2016 (in thousands of people)

Note: mining municipalities are defined as municipalities in which hard coal mines have been or used to be operated.

Source: WiseEuropa based on Eurostat data.



THE POPULATION IN MINING MUNICIPALITIES DECREASED BY 8.3% BETWEEN 2000 AND 2017. BY 2030 IT IS EXPECTED TO SHRINK BY ANOTHER 8.5%

In this context, the decreasing number of inhabitants of the Silesian Voivodeship, which is a consequence of low rate of natural increase and emigration, is a big challenge. Demographic forecasts produced by the Central Statistical Office indicate that in the long term these tendencies will continue, and the decrease in the number of region inhabitants in the years 2017-2030 will clearly be more pronounced than in the years 2000-2015, also in comparison to the whole country. The Central Statistical Office predicts that in 2030 the population in Poland will be 2.1% lower, and in the Silesian Voivodeship even 5.7% lower, than in 2017. Meanwhile, maintaining the high level of economic development in the region will be a lot more difficult if the shortfall of over 250 thousand people is not replenished by immigration either from other regions or from abroad. The forecast produced by the Central Statistical Office shows a significant discrepancy between the mining and non-mining regions. In mining municipalities, a decrease in population is predicted of as much as 8.5 %, and in non-mining municipalities only 2.7%, which is approximately the same as in the rest of the country. **Therefore, the number of inhabitants of Silesian Voivodeship will decrease the most in the Katowice and Sosnowiec subregions, which are the most affected by the restructuring of hard coal mining, and it will remain the same in the subregions of Tychy and Bielsko-Biala, i.e. the ones not burdened with the necessity of transition.**

DEPOPULATION

The number of inhabitants will decrease the most in the Katowice and Sosnowiec subregions, which are and were the most affected by the restructuring of hard coal mining. The population will remain the same in the subregions of Tychy and Bielsko-Biala, i.e. the ones not strongly affected with the necessity of transition





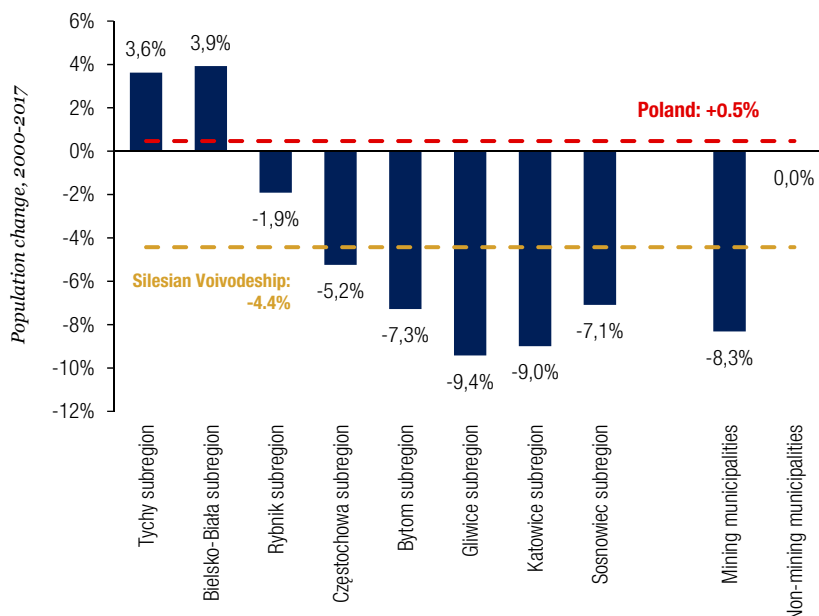


Figure 20. Change in the total population in subregions and groups of municipalities in the years 2000-2017 (%)

Source: WiseEuropa based on the data from Central Statistical Office.

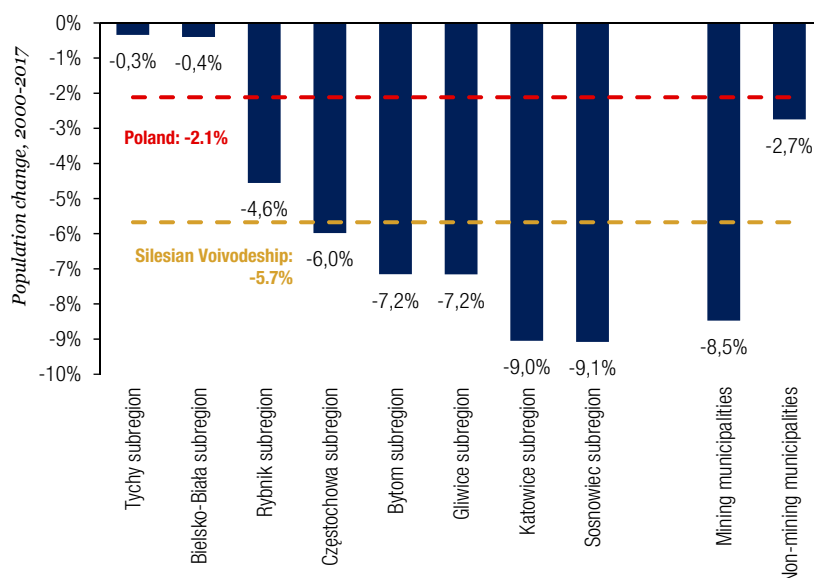


Figure 21. Forecast of change in the total population in subregions and groups of municipalities in the years 2017-2030 (%)

Source: WiseEuropa based on the data from Central Statistical Office.

It is worth noting that the depopulation processes in Upper Silesia are nothing new. According to the data from the Central Statistical Office, the overall population in Poland in the years 2000-2017 increased by 0.5%, but this was not the case in the Silesian Voivodeship, in which the population decreased by 4.4%. The decrease in population was greater only in the Łódzkie Voivodeship – also affected by the problem of restructuring – and in the Opolskie Voivodeship, where emigration abroad had a major impact. Characteristically, the mining municipalities were responsible for the decrease in the region's population. In the years 2000-2017, the number of people who lived in these areas decreased by 8.3%, while the number of inhabitants of non-mining areas remained unchanged. This means that there was emigration from the voivodeship and migration within the voivodeship in search for better living and employment conditions.

The intensity of economic problems of the transition period and the capability of making use of the opportunities provided by accession to

AS THE TRANSITION OF THE MINING SECTOR IS FAR FROM OVER, THE WHOLE SILESIA VOIVODESHIP, AND ESPECIALLY THE AREAS WITH OPERATIONAL MINES, WILL HAVE TO DEAL WITH DEPOPULATION PRESSURE

the European Union influenced the degree to which individual parts of the Silesian Voivodeship were affected by the depopulation problem. The subregions of Bielsko-Biała and Tychy, which are rapidly developing economically are the only ones in which the number of inhabitants has increased in the last ten to twenty years. This cannot be said about the Gliwice region, which, despite good economic results, was at the same time one of the regions with the greatest changes in hard coal mining in the 1990s, which translated into decreased demand for employees in this industry and emigration of some mining families from the region. The highly productive industrial plants located in this subregion did not create enough jobs to compensate for this outflow. As the transition of the mining sector is still far from over, the whole Silesian Voivodeship, and especially the parts with still operational mines, will still have to deal with depopulation pressure.

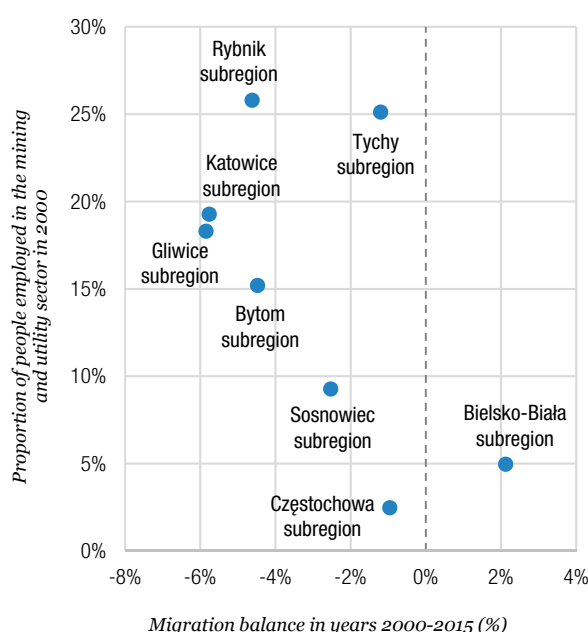


Figure 22. Total migration balance in years 2000-2015 and the percentage of people employed in mining and the public utility sector in 2000

Source: WiseEuropa based on Eurostat data.

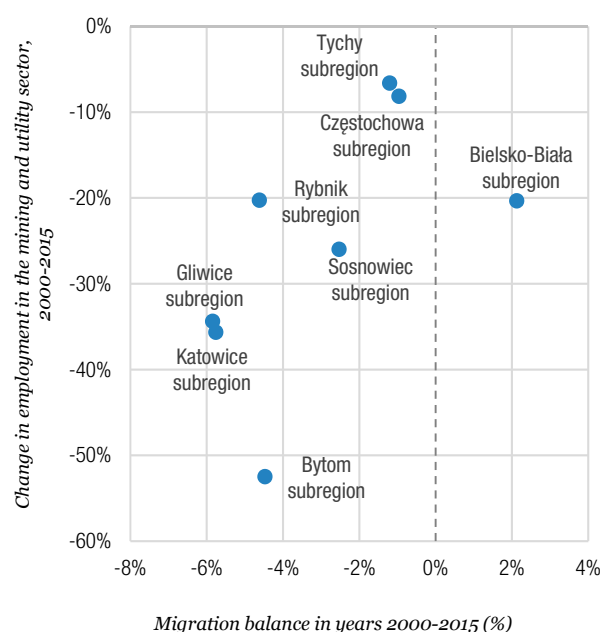


Figure 23. Migration balance and change in the percentage of people employed in mining and the utility sector in the years 2000-2015

Source: WiseEuropa based on Eurostat data.

The demographic problems of the Silesian Voivodeship are caused by both the negative rate of natural increase, and the outflow of people to other regions and abroad. The negative rate of natural increase in the region has so far affected mainly the mining municipalities. Depopulation also has the side-effect of an increasingly aging population. It has almost the fastest rate for this process in the country, and the ratio of people in pre-working age, post-working age, and working age is becoming less and less favourable. By 2030, the percentage of working-age people (aged 15-64) in the population of the voivodeship will fall to 62% – almost 10 p.p. lower than in the year 2000. The intensive change in the age structure of the population due to people moving from the 15-64

age group to the 65+ age group will be especially visible in the mining municipalities. In the years 1995-2015, the percentage of people of working age was higher in these municipalities than in non-mining municipalities or in the rest of Poland. However, according to the forecast by the Central Statistical Office, after 2015 this will not be maintained. **This conclusion reinforces the theory that new inhabitants will have to be attracted to the region, especially young people and families with children, to fill up the gap in workforce that will exist in many parts of the voivodeship in the next decade.**

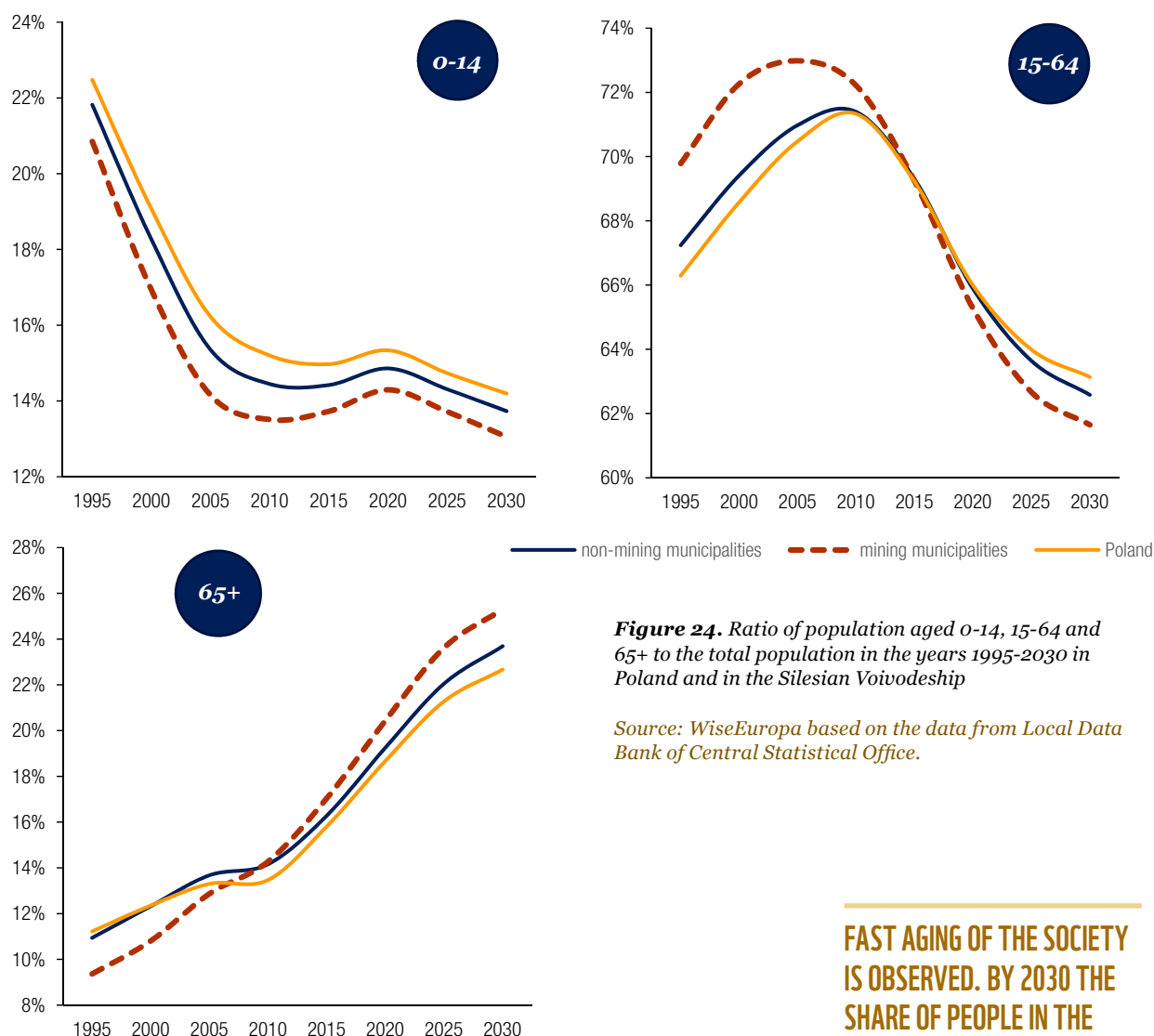


Figure 24. Ratio of population aged 0-14, 15-64 and 65+ to the total population in the years 1995-2030 in Poland and in the Silesian Voivodeship

Source: WiseEuropa based on the data from Local Data Bank of Central Statistical Office.

FAST AGING OF THE SOCIETY IS OBSERVED. BY 2030 THE SHARE OF PEOPLE IN THE WORKING AGE (15-64) IN THE VOIVODESHIP WILL FALL TO 62%: ALMOST 10% LOWER THAN THE VALUE IN 2000

In recent years both the balance of internal migration and migration abroad was negative. Reversal of this trend seems to be one of the key developmental challenges of the region in the years to come. Changing the migration balance from negative to positive – although difficult – may be easier (due to international migration) than changing the fertility and birth patterns in the region. **However, this requires rendering the region attractive to potential immigrants by making it more attractive both in terms of the job market and the living conditions of its population. This will require a major effort on the part of the local authorities and cooperation from the central government.** As the region is industrially oriented and still faces significant restructuring challenges in many parts, this problem, however, is especially urgent. Economic development of the Silesian Voivodeship conditional upon it continuing to attract investments in industry and services at a level not only capable of compensating for the outflows from the mining industry and its related fields, but also sufficient to achieve production levels per capita comparable at least with the European average. The gap in production per inhabitant of not only the most industrialised regions of the EU, but also, but not only, of the south-eastern federal states in Germany is still big, and eliminating it requires both capital to increase productivity in companies, and an uninterrupted influx of human resources ensuring that the region will remain attractive to investors.

Figure 25. Total rate of natural population growth in Polish voivodeships in the years 1995-2016 per 1,000 people

Source: WiseEuropa based on Eurostat data.

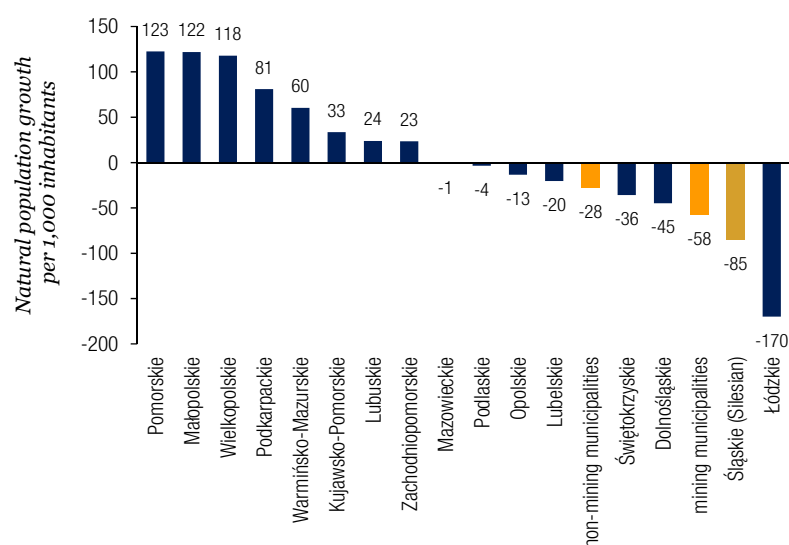
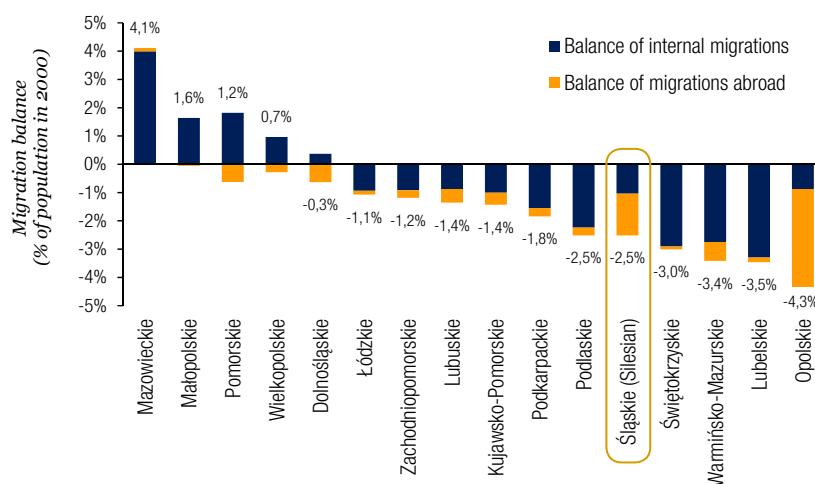


Figure 26. Total balance of internal migration and migration abroad in Polish voivodeships in the years 2000-2015 in relation to the population in 2000 (in thousands of people)

Source: WiseEuropa based on Eurostat data.



3. HOW TO SUPPORT SUSTAINABLE DEVELOPMENT IN THE REGION?

3.1. Changes in the mining and energy industries

Inevitability of change

As early as in the second half of the 19th century, the availability of rich deposits of hard coal determined the economic profile of Upper Silesia, when the mines and steelworks located there initiated intensive urbanisation and a rapid increase in the region's population. This trend was reinforced in the 20th century, when hard coal became the basic fuel for the energy sector and industry. As a result of these processes, in Upper Silesia, a symbiosis was created between hard coal mining, the energy sector and heavy industry. As industrialization progressed, coal extraction in the Silesian mines was increasing, reaching an all-time high by the end of the 1980s. Around the year 1990, this trend reversed and the Silesian mines started quickly reducing coal production for energy and industrial purposes, largely following the pattern known from other European countries, such as the UK, Germany, France, and Belgium, in which, after the fuel crises of the 1970s, technological reconstruction was implemented – both in industry and the energy sector, and demand for coal fell. Combined with the increasing costs of mining induced by the deteriorating geological conditions and rising pay in the overall economy, hard coal production started declining, focusing on the most economical deposits (Bukowski et al. 2015). The reason for this was competition with regard to pay with the manufacturing, offering an alternative career path for skilled workers. Maintaining productivity at a level allowing sufficiently high pay requires production to be more mechanized and a focus it on the most economically promising deposits, which translates into gradual reduction of the workforce and the level of extraction in the sector.

THE AVAILABILITY OF RICH DEPOSITS OF HARD COAL DETERMINED THE ECONOMIC PROFILE OF UPPER SILESIA IN THE SECOND HALF OF THE 19TH CENTURY

A SYMBIOSIS BETWEEN HARD COAL MINING, THE ENERGY SECTOR AND HEAVY INDUSTRY WAS CREATED IN UPPER SILESIA, REACHING AN ALL-TIME HIGH BY THE END OF THE 1980S

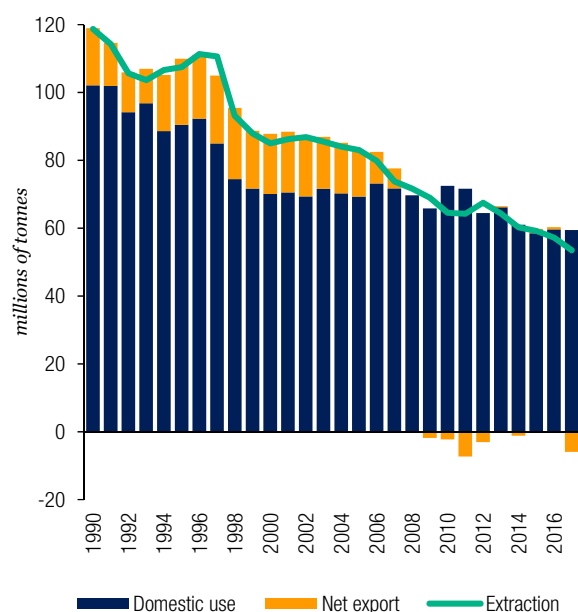


Figure 27. Extraction, domestic use and net export of steam coal in Poland, 1990-2017

Source: WiseEuropa based on Eurostat data and Bukowski et al. (2015).

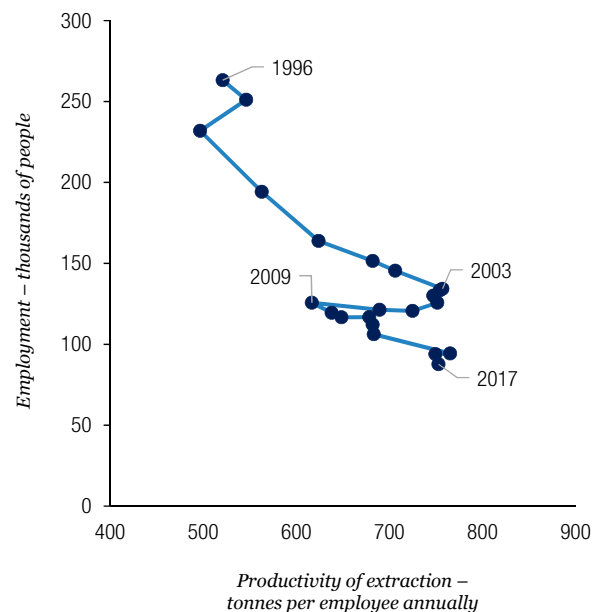


Figure 28. Employment in mining and efficiency of hard coal extraction in Poland in the years 1996-2017

Source: WiseEuropa based on Eurostat data and Bukowski et al. (2015).

**BEFORE 2050 THE LAST
UPPER SILESIA MINES
PRODUCING STEAM COAL
CAN BE EXPECTED TO
CEASE OPERATING**

Areas of change

The detailed forecast of the level of extraction and number of people employed in the sector up until 2050 confirms that this trend will be sustained in the future: the wage increases necessary to achieve the level of prosperity enjoyed in Western Europe will force the Silesian mining sector to achieve a significant improvement in extraction productivity, limit its volume, and significantly decrease the workforce. Before 2050, the last Upper Silesian mines producing steam coal can be expected to cease operating. Production of coke will probably go on longer, however, the number of people employed in the sector will fall below the level of 10 thousand people, i.e. more than seven times below the current level (Fig. 29).

Even if the forecast takes into consideration the opening of the two new mines announced in the Programme for Silesia (leaving aside the problem of social acceptance for these investments by the local communities), the picture of the decline in the sector is not going to change – the prospects for the resource supply and the role of the industry in the

regional labour market will decrease year by year. The current situation, in which mining is no longer able to satisfy the domestic demand for coal, is therefore a permanent one. Without reconstructing the production capacities in the domestic energy industry (starting with the Silesian Voivodeship) and limiting the demand for coal from other economic sectors, a significant increase in imports of this resource will be inevitable.

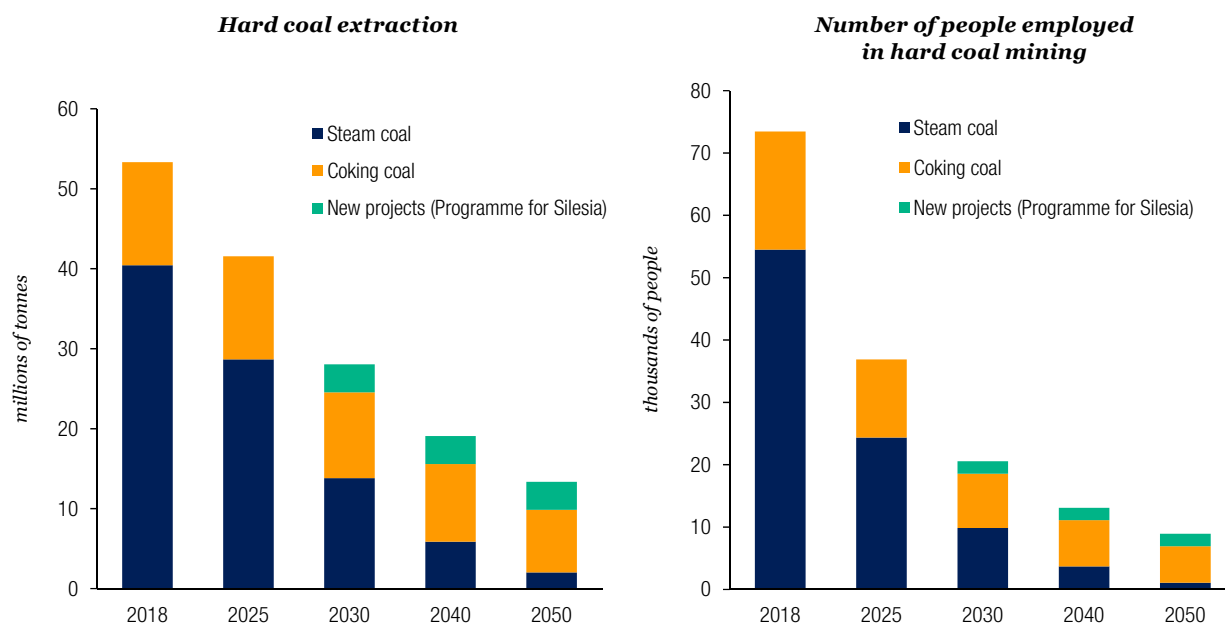


Figure 29. Extraction and the number of people employed in hard coal mining in the Silesian Voivodeship, forecast for the years 2018-2050

Key assumptions: 1) the steam coal price in long-term stabilised at a level of PLN 335 per tonne, and coke – PLN 770 per tonne (in real 2018 prices); 2) we take into consideration the announcements concerning opening of two new mines included in the Programme for Silesia; 3) the minimum sales profitability allowing for the operation of mines is at the level of 7.5% (with typical market values of 15%), which ensures the means for investments and maintaining liquidity in periods of recession; 4) mines in Silesia will gradually increase productivity in order to boost revenues per employee and be able to pay competitive remuneration (rising in accordance with the trend for the whole economy). The maximum level of productivity that can be attained is 1400 tonnes per employee until 2025 and 2000 tonnes per employee in the years 2030-2050.

Source: WiseEuropa's own forecasts.

The scale of the workforce and the pace at which it is being restricted in the sector in the coming decades will be a challenge for the labour market. In the period up until the 2030s, the main problem will be the shortage of permanent (based on profitable extraction and taking into consideration growing expectations of miners with regard to pay) jobs in the sector. Technological modernisation of the sector (e.g. the development of “intelligent mines”) will not solve this problem, as the necessary innovations improving the competitiveness of mining will have to severely limit the labour costs, and, therefore, the number of people employed in the field. In other words, the implementation of productivity-increasing technologies of hard coal extraction is vital in order to maintain any jobs in the Upper Silesian mining sector.

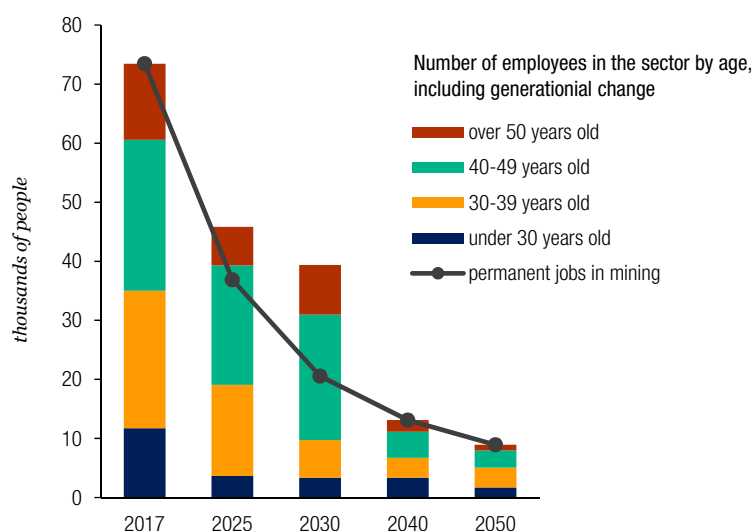
WITHOUT LIMITING THE DEMAND FOR COAL IN THE ENERGY AND OTHER ECONOMIC SECTORS, THE DECLINE IN STEAM COAL EXTRACTION IN UPPER SILESIA WILL LEAD TO A FURTHER INCREASE IN IMPORT OF THIS FUEL

Even after taking into consideration the natural rotation of human resources related to older employees retiring, mining in 2030 will be able to maintain only half of the people currently employed in the field, i.e. approximately 20 thousand permanent jobs out of the 40 thousand current employees who will still be professionally active at that time. However, avoiding the generation gap and maintaining extraction in the most efficient mines in the region until the 2040s will require hiring new employees. The net needs of the sector in this respect (approximately 340 people annually) will probably be several times lower than in the previous years, and approximately three times lower than currently signalled by coal companies. At the same time, due to the last crisis and limited intake of new employees in 2015, despite the previous commitments made by coal companies, the number of mining school students fell significantly (to approximately several dozen in the latest classes). The new employment guarantees currently announced by mining companies can – similarly to the previous period of recovery – again increase the interest of young people in mining schools. However, this will probably not be a mass trend. The potential overestimation of the demand for new employees on the part of mining companies during the next economic slowdown could have long-term consequences, leading to the final loss of interest in the field by people entering the labour market after another crisis, thereby significantly hampering the replacement of human resources after 2030. This, in turn, will accelerate the loss of competitiveness even by the most efficient mines. Thus, the field is facing a twofold challenge: avoiding having an excessive workforce in the next ten to twenty years and shortage of staff in the long-term. In this context, the challenge will comprise of both efficient retraining of the employees leaving the mining sector in the 2020s and 2030s, and maintaining the interest in the sector on the part of a limited number of people in the future.

Figure 30. Number of employees in hard coal mining according to age groups, forecast for the years 2018-2050

Key assumptions: constant influx of employees limited to the level necessary to avoid a labour shortage by 2050 (approximately 340 people annually in the years 2019-2040 and 170 people annually in the years 2041-2050).

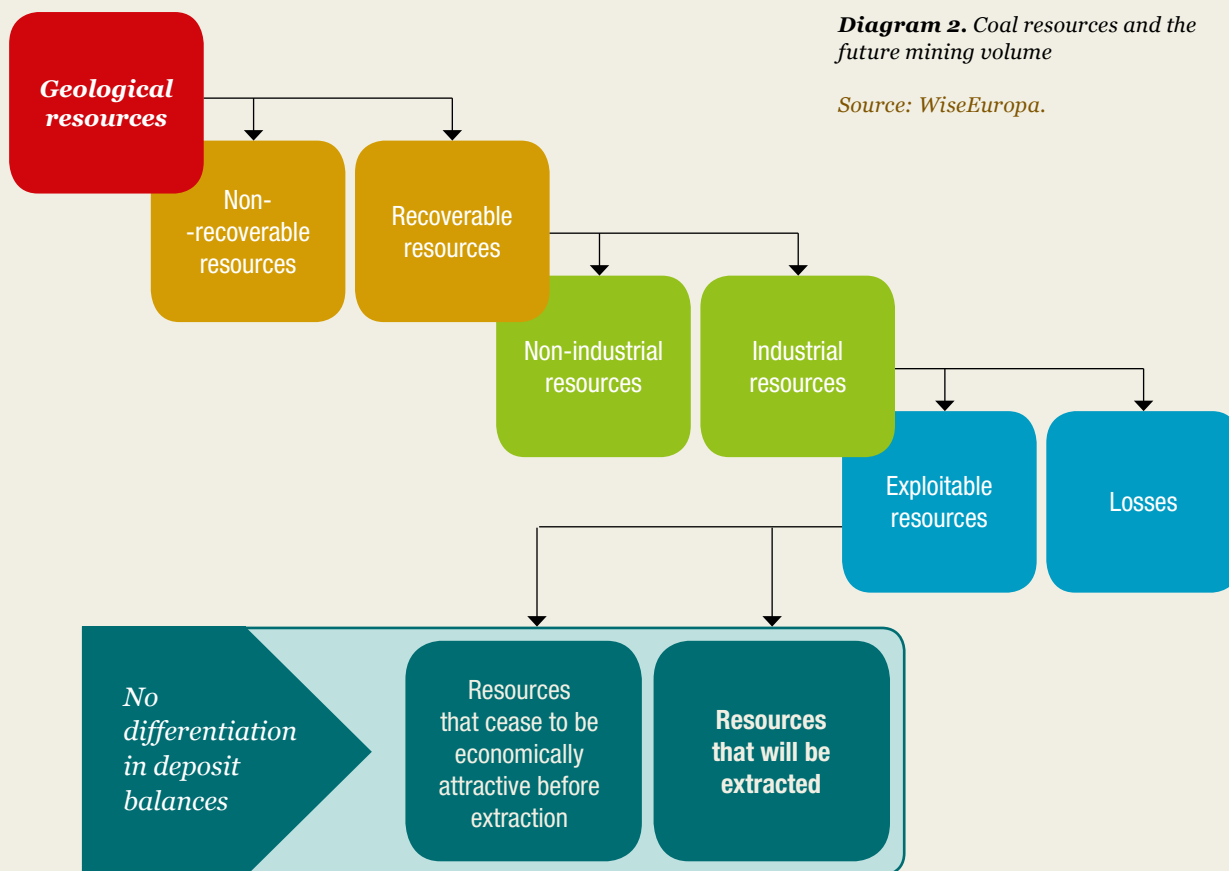
Source: WiseEuropa's own forecasts.



Box 4. WHAT DO CURRENT ASSESSMENTS OF HARD COAL DEPOSITS TELL US ABOUT THE FUTURE MINING OPERATIONS?

A significant element of the debate on the future of mining in the Silesian Voivodeship is the issue of hard coal deposits. Despite the gradual decline in production and the workforce in the Silesian mines, the industry has suggested that there is a possibility of maintaining its activity in the long run, thanks to the utilisation of coal deposits present in the Upper Silesian Coal Basin. The current extraction levels counted in tens of millions of tonnes annually are compared with the total coal deposits in the Basin, estimated at tens of billions of tonnes. A closer look at the classification of the deposits and the changes in their levels over time indicate, however, that even rich deposits do not guarantee that extraction can be maintained in a given mining region.

This is because it will only be possible to extract a small portion of coal deposits. First of all, of the total volume of coal in a given field (**geological deposits**), only some has the proper physical parameters (e.g. depth at which it is found) – these are **recoverable resources**. Secondly, only a portion of the recoverable resources can be used in an economically justified way – these are **industrial resources**. These are additionally reduced by the resource losses (approximately 40-45%) in the production process. Only then the **exploitable resources**, i.e. those that can in fact be delivered to the market according to the current technical and economic parameters are counted.

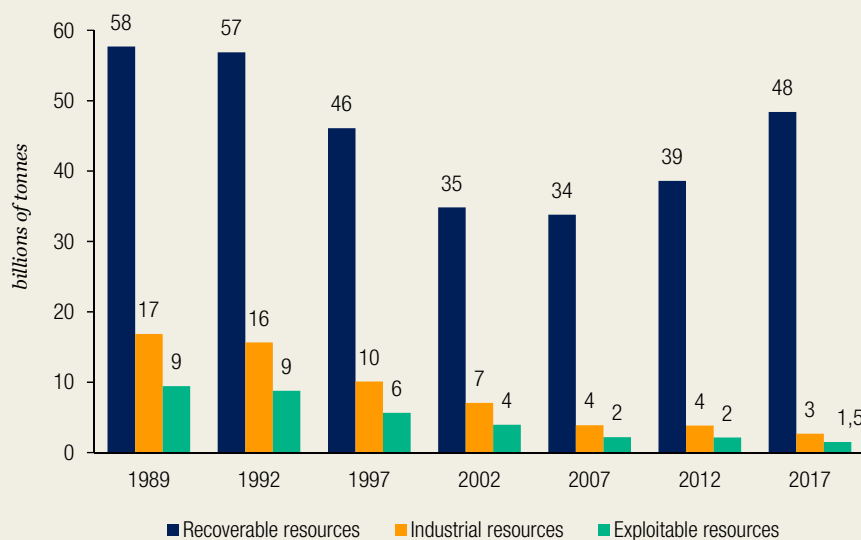


At the same time, individual types of resources change over time. Geological studies can provide more information about deposits, thereby increasing recoverable resources. At the same time, however, the economic environment in the sector changes, affecting the profitability of producing coal from a given deposit, which in turn affects the assessments of the size of its industrial and exploitable resources. For example, an increase in labour costs when the level of mining productivity is increasing too slowly in underground mines or its excessive capital intensity will translate into escalation of the hard coal production overheads, causing its decline and limitation of industrial resources. Within the three last decades, this

problem has occurred in Silesia: despite reversal of the declining trend with regard to recoverable resources, the level of extraction is falling in real terms, and the extractable resources are decreasing as successive mines become less competitive and deposits in the other mines run out. There is also a significant socio-economic factor, which is the disapproval of mining investments on the part of local communities. Together with increased prosperity of the inhabitants, development of the modern manufacturing and services, and expansion of surface infrastructure, the costs of potential damage due to the mining activity in a given area increase. Therefore, the extraction potential in densely populated areas is limited.

Figure 31. Recoverable, industrial, and exploitable resources in the Upper Silesian Coal Basin

Source: WiseEuropa based on data from the Polish Geological Institute – National Research Institute, the Ministry of Energy (2018), and Probierz et al. (2007).



The decline in exploitable resources and the decrease in the level of extraction in the Upper Silesian Coal Basin are taking place at a very similar pace. For more than two decades, the estimated moment at which minable coal deposits in Upper Silesia will run out has been the 2040s. This is not changing despite the clear decrease in coal production, which – as one might think – should lead to extension of the period of potential exploitation of particular deposits. This means that gradual shutdown of hard coal mining in the region is inevitable, and most of the industrial

resources shall remain unused due to purely economic reasons. Estimates of the future coal extraction in Upper Silesia cannot, therefore, be based only on the current assessment of the amounts of exploitable resources. They also have to take into consideration the factors affecting the current and future competitiveness of the industry, especially the dynamics of labour costs in the region, technological capability of increasing the productivity of extraction and the potential for its market price going up.

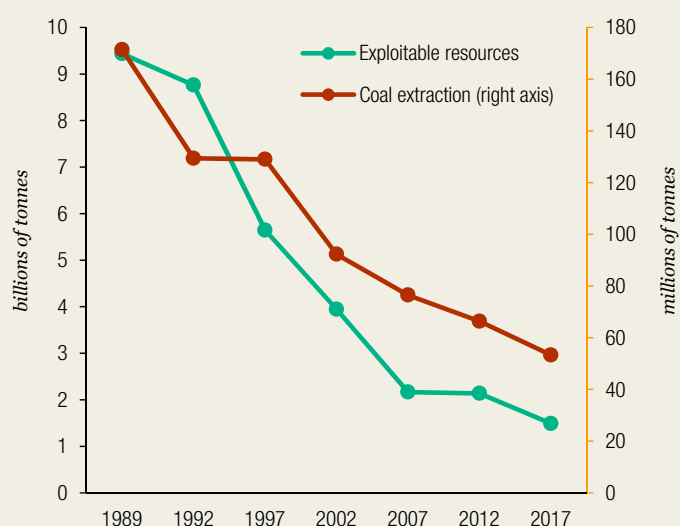


Figure 32. Exploitable hard coal deposits and coal mining in the Upper Silesian Coal Basin

Source: WiseEuropa based on the data from the Polish Geological Institute – National Research Institute, the Ministry of Energy, and Probiez et al. (2007).

	Remaining years of extraction	Expected final year of extraction
1989	55	2044
1992	68	2060
1997	44	2041
2002	43	2045
2007	28	2035
2012	32	2044
2017	28	2045

Table 3. Sufficiency of exploitable resources in the Upper Silesian Coal Basin assuming constant extraction from a given year

Source: WiseEuropa based on the data from the Polish Geological Institute – National Research Institute, the Ministry of Energy, and Probiez et al. (2007).



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Policy for development of the region in light of the changes

An efficient policy of development of the Silesian Voivodeship means accepting the inevitability of losing economic competitiveness of hard coal mining, and the fact that during the next twenty years most of the existing mines will shut down extraction, and the potential new locations – due to objective, economic conditions – will be able only to a small degree fill the resulting gap in the supply of the black fuel. On the other hand, it is necessary to understand that the changes in the Silesian mining sector and the worldwide technological trends will affect the energy companies active in the region. They will have to undergo major transition based on replacing the production capacities based on coal with renewable and gas resources, which, in turn, will mean changes in the way competencies and space are structured due to their demand for labour. On the economic side, the Silesian Voivodeship will, therefore, require that the traditional competitive advantages be replaced with new sources, the expectations of which, in view of the local development policy, are different from the expectations for the mining-energy complex.

The change of the paradigm on which the development of Silesia is based requires specifically:

- time for planning adjustment activities and implementing them,
- the possibility of making savings and distributing the resources facilitating the transition of companies and units affected by the changes,
- formulating realistic expectations of stakeholders regarding the scale and pace of reforms.

Unfortunately, practice to date has been based on postponing the announcement of closure of mines and reducing the workforce in mining companies, which means keeping employees and other concerned parties in a state of uncertainty that lasts for months. This creates unnecessary tensions and undermines trust both on the part of miners and local authority institutions. In the case of hard coal mining employees, presentation of realistic medium- and long-term plans for restructuring the sector would allow early preparation for the prospect of changing jobs, and for the people currently only considering choosing mining as a career – a realistic evaluation of their professional prospects. Providing information in advance about the plans for gradual reductions of the number of employees in the mining industry would also enable more effective activities of local authorities and labour market institutions, giving them time to devise support for the people affected by the restructuring programme and collecting the resources necessary for this purpose. The information that the demand for new employees in hard coal mining will be decreasing should be distributed among young people (specifically, information from mining companies is important in this case), and the people looking for work or expanding their qualifications should seek employment in other sectors. Importantly, coal companies can also benefit from the realistic approach to long-term development of the sector. A policy of not leaving changes until the last moment (when there is no longer any choice due to the poor financial

**AN EFFICIENT POLICY OF
REGION DEVELOPMENT
MEANS ACCEPTING THE
PROSPECT OF ALMOST FULL
DISAPPEARANCE OF JOBS IN
THE MINING SECTOR WITHIN
THE NEXT TWO DECADES**

**RESTRUCTURING
THE MINING SECTOR
REQUIRES NOT ONLY A
REAL ASSESSMENT OF
THE PROSPECTS FOR ITS
DEVELOPMENT, BUT ALSO
A TRANSPARENT MESSAGE
IN THIS RESPECT DIRECTED
AT THE INHABITANTS OF
THE SILESIAN VOIVODESHIP,
MINERS, AND ENERGY
SECTOR EMPLOYEES**

standing of a company) will mean that resources in energy-mining companies can be better allocated, allowing all of the possible restructuring scenarios to be considered. This will avoid hasty decisions being made for example due to the prospect of losing liquidity during the recession. At the same time, more resources will be able to directed towards the real diversification of activities, and therefore maintaining the companies' development prospects in the long term.

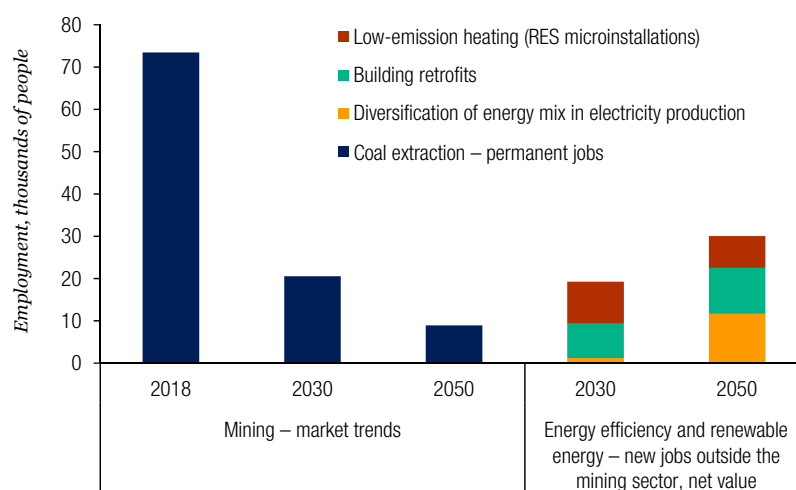
Managing changes in hard coal mining

Restructuring the mining sector requires not only a realistic assessment of the prospects for its development, but also a transparent message in this respect directed at the inhabitants of the Silesian Voivodeship, miners, and energy sector employees. Without informing the individual groups of stakeholders about the probable future of the field, it is hard to count on a peaceful restructuring that at the same time will be beneficial for the region. The decline in the mining industry can be also accompanied by creation of new jobs connected with low-emission investments in other sectors, including the energy and construction sectors. These sectors can jointly generate a positive impulse for the Silesian labour market at a level corresponding to 20 thousand employees in 2030, and 30 thousand in 2050. This means that this impulse will correspond to the number of jobs in hard coal mining that will become uneconomic by the end of the 2020s. This points to the consistency between the programmes of thermomodernisation and diversification of the country's energy industry and the support actions for employees to move from mining to other sectors. Although the same actions for the development of renewable energy sources and the improvement of energy efficiency of buildings should not be treated as the only solutions for the challenge of restructuring local labour markets, they might be helpful in this process. Delaying the technological transition of the energy sector in order to maintain demand for coal when there are growing problems with ensuring its supply, therefore, is not an effective way of avoiding the challenges of restructuring the mining sector.

Figure 33. The number of employees in hard coal mining and jobs generated outside the mining sector by low-emission investments in the energy sector and buildings in the Silesian Voivodeship, 2018-2050

Key assumptions: implementation of a country-wide programme of thermomodernisation and heating source replacement, as well as increase of the share of renewable energy sources in the electricity generation mix to 70% (see Bukowski et al. 2017, Ecke et al. 2017).

Source: WiseEuropa's own forecasts.



The demographic problems of Upper Silesia and the probable problems with the influx of new employees to the sector in the 2030s together make the full utilisation of the potential of the best miners a necessity for mining companies. For this to happen, the main requirement is to change the approach to employment in the mining sector: from “whole professional career in a mine” to “mining as one of several career stages.” It would be advisable to also change the social security and collective agreements regulations, as they currently hamper management of the sector restructuring. Specifically, the current policies regard eligibility for a miner’s pension are of zero-one nature: one must have 20-25 years’ service in mining to become eligible for early retirement and a pension determined on the basis of favourable conversion factors. This form of regulations creates a strong stimulus for binding one’s whole professional career with mining, and, at the same time, it increases the costs of restructuring: the miners that leave the profession lose not only relatively high salaries, but also the prospect of additional retirement benefits. This exacerbates the conflicts surrounding the necessary remedies in periods of recession, which, in turn, are alleviated by additional social welfare measures, such as leave for miners.

Introducing solutions allowing the miners currently in work to gradually become eligible for additional pension benefits as their length of service in a mine increases would improve the management of restruc-

TODAY, OBTAINING QUALIFICATIONS IN THE MINING SECTOR IS OF A ZERO-ONE NATURE, WHICH EXACERBATES THE CONFLICTS SURROUNDING THE NECESSARY RESTRUCTURING

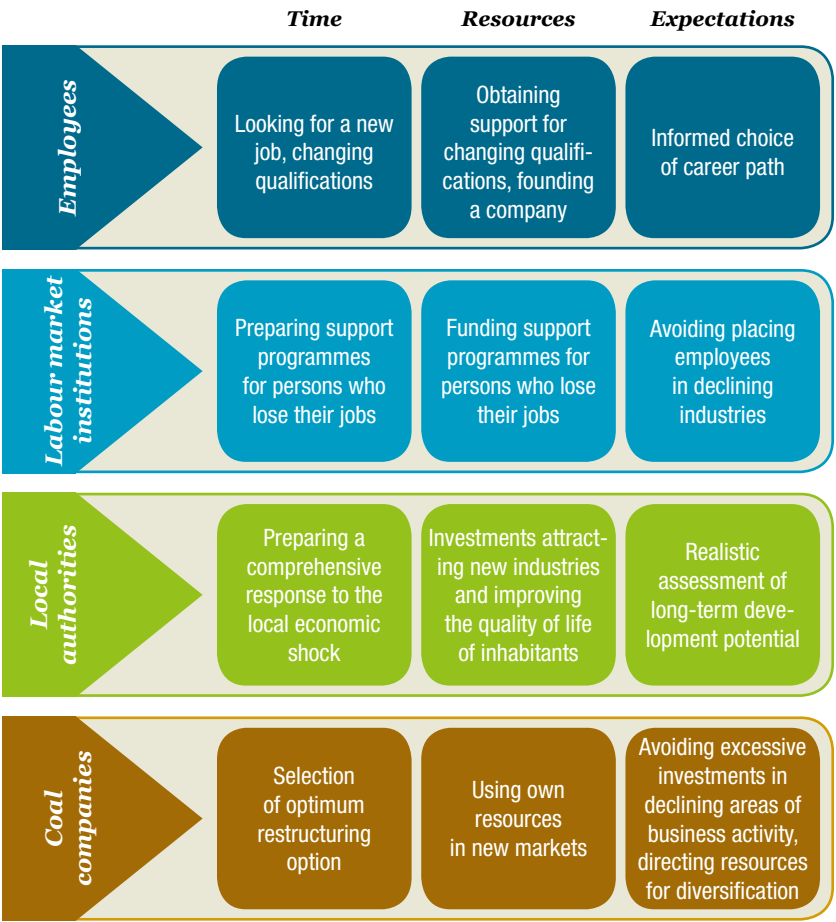


Diagram 3. The conditions for effective management of change in the mining sector

Source: WiseEuropa.

turing of mining companies, making it easier for the miners to shape their own career paths, so that working in the mining industry would become one of several stages of their activity in the labour market. It would also be desirable to include miners in the general pension system: mines should pay higher contributions into miners' pension accounts, and they would, in turn, become entitled to early retirement in a linear way, as their length of service increases. In the case of new employees or employees with a short period of service, a better option would be to deduct an additional contribution (as part of Employee Capital Programmes or Employee Pension Programmes) complementing the pensions paid out according to general principles. This would lead to a permanent change of the nature of miners' work towards a system more adjusted to the challenges faced by the region. Employment in the sector could be shorter or longer but still just a stage of a career – work performed for above-average gross remuneration, in a manner similar to other professions with hard working conditions.

Fuel-energy system

The changes in the mining sector must be accompanied by modernisation of the fuel and energy system, including not only electricity supply, but also investments in low-emission technologies in buildings, transport and manufacturing. These changes should be consistent with the technological trends and long-term emission reduction targets in Europe, and with the needs for radical improvement of air quality in the region. At this point it should be emphasised that maintaining conventional power technologies in the energy sector as the guarantee of local demand for coal, and indirectly also for the companies providing technical solutions for mining, is not an attractive development alternative – the supply of coal in the Silesian Voivodeship will fall due to economic and geological limitations, and coal imports will increase, mostly from Russia. In order to ensure permanent prosperity of the inhabitants of the region, it would be much more beneficial to create local demand for the technologies that have excellent prospects in the global markets.

**CHANGES IN THE MINING
SECTOR MUST BE
ACCOMPANIED BY THE
MODERNISATION OF THE
FUEL AND ENERGY SYSTEM:
NOT ONLY ELECTRICITY
SUPPLY, BUT ALSO INVEST-
MENTS IN BUILDINGS,
MANUFACTURING AND
THE TRANSPORT SECTOR**

The investments translating into qualitative changes in managing energy and radically reducing pollution emissions (renovation of a large number of buildings, development of integrated railway and intermodal transport systems, technological transition in the energy sector, etc.) usually involve a high level of capital intensity and organisational complexity. However, their realisation – among other things thanks to significant reduction of demand for fuels – allows to reduce the operating costs connected with meeting energy, transportation, and consumption demand of the region's inhabitants. At the same time it ensures a rapid improvement of the environmental quality, and opening international development prospects for the local vendors providing low-emission solutions. In view of the global trend of significant reductions of emissions in the energy sector, reflected for instance in the Paris Agreement, investments in conventional technologies for producing and using energy are associated with a serious risk of turning into stranded assets. This will result in premature withdrawal from use and incurring double the multibillion investment costs: firstly for coal

units or emission-intensive transport systems with a short-term functioning prospects, and secondly for low-emission solutions that will have to replace them within just a few years or between ten and twenty years, when operational profitability of the conventional solutions turns permanently negative.

The change currently taking place in the European and global capital markets provides an additional argument for directing the attention of energy companies and other investors active in the Silesian Voivodeship to low-emission technologies. Following the international financial institutions (pension funds, investment funds, and banks) withdrawing from emission-intensive investments, in Europe, Asia and North America, measures are being taken to mobilise private funds for alternative solutions, guaranteeing the investors achieving emission reduction consistent with the goals of the Paris Agreement of 2015, and, at the same time, manufacturers of consumer goods take care to minimise the so-called carbon footprint in their products, reducing the use of energy from emission-generating sources. An example of such measures is the initiative “Climate Action 100+,” which has now been joined by over 250 institutions in the financial sector, managing assets worth USD 28 trillion. As part of the initiative, investors put pressure on a group of companies – the biggest sources of greenhouse gas emissions – to take measures to reduce emissions, pursuant to the Paris Agreement.

In the case of the European Union, the action plan for sustainable financing announced in 2018 is aimed among other things at clear separation of investments contributing to significant reduction of greenhouse gas emissions from the ones that are not consistent with the plans for low- or zero-emission modernisation of the European energy system. Similar initiatives have been announced by financial market regulators in China and Japan, while in the US they are performed in the form of capital market self-regulation. With this global trend in mind, a quick shift of private investors from funding coal projects to zero-emission investments should be expected (such actions have already been taken for example by Allianz, Aviva and the ING Group). This will lead to gradual deterioration of the conditions of funding conventional technologies caused by the necessity of one funding party to bear additional regulatory and operational risks. Where the focus is on energy transition, in the long term the Silesian Voivodeship will benefit not only from lowering the costs of meeting energy needs, but also from easier access to private funds for the modernisation projects performed in the region.

**GLOBAL TRENDS SUGGEST
THAT A QUICK SHIFT OF
PRIVATE INVESTORS FROM
FUNDING COAL PROJECTS
TO ZERO-EMISSION
INVESTMENTS SHOULD BE
EXPECTED**

Sector	Maintaining the current direction of fuel and energy system development	Qualitative systemic transition consistent with modernisation needs
Energy	Slow development of distributed energy sources, maintaining conventional coal technologies in electricity and heat generation.	Combining the development of intelligent networks with dispersed energy technologies, including renewable energy sources, managing demand and storing energy.
Buildings	Shallow thermal modernisation according to the standards dominating the market, gradual connection of buildings to the district heating networks.	Deep thermomodernisation combined with the application of zero-emission heat sources or connecting to low-emission heating systems.
Transport	Gradual replacement of the current public transport fleet with low- and zero-emission vehicles, gradual expansion of the power supply infrastructure for electric vehicles and other low-emission drives	Shift of mobility towards public transport – zero-emission buses and rail vehicles, limiting the use of conventional emission-intensive passenger cars in cities.
Heavy industry	Improvement of energy efficiency of the currently used industrial processes.	Pilot implementation of the zero-emission production technologies (including electrification, using hydrogen, synthetic fuels, CCS/CCU installations).
Integrated projects	Integrated approach used only in selected projects, limited to the use of various technologies in a given building or creating single connections between systems.	Managing energy at the level of housing estates and districts, combining individual energy systems (electricity, district heating, gas, industrial energy, and waste heat).

Table 4. Two modernisation pathways for the regional fuel and energy system

Source: WiseEuropa.



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Box 5. PENSION PRINCIPLES FOR THE MINING INDUSTRY IN COMPARISON TO OTHER SECTORS OF THE ECONOMY

People working in the mining industry are one of the few professional groups in Poland outside the general pension system. Miners' pensions are connected to additional, industry specific rights, such as the possibility of early retirement and the application of a favourable service period conversion factor based on the old system of calculating pensions, from before the reform of 1999.

Early retirement is an option for employees who have reached the age of 55 and have worked for a minimum of 20 years in the case of women and 25 years in the case of men, including at least 10 years of mining work. In the case of work in mining for 15 years, it is possible to retire at the age of 50. However, if a person has worked in mining underground full-time for 25 years, they can retire regardless of their age.

Miners' pensions are calculated on the basis of length of service and salary levels in a given period of career – the longer the period of service and the higher the salaries, the higher the pension. This method was also used in the general system, but it did not strike a balance between the deducted contributions and the received benefits. Since the pension reform of 1999 (from which the miners were excluded after their protests in 2005), the amounts of pension benefits have depended on the sum of the deducted contributions and the subsequent life expectancy – which (in approximation) allows a balance to be found between pension system remittances and withdrawals. In the case of people employed in mining, there is no similar mechanism, but there are special conver-

sion factors extending the length of service applied when calculating miners' pensions. They are, respectively, 1.5 for every year of mining work performed underground, and 1.8 for every year working in a rescue team or performing activities connected to hollowing workings and for operation supervision employees and mine operation management, provided this work was performed for at least 5 years. When specifying the amounts of miners' pensions, the total work period that can be calculated using the conversion factors cannot exceed 40 years.

Miners can also make use of miners' leave, which means that pension rights can be obtained in cases of early redundancy (for example when a mine is closed down). The maximum duration of such leave is 4 years, and during this leave the employee receives social benefit funded by the state budget, equal to 75% of monthly remuneration calculated in the same way as remuneration for holiday leave.

Mining is not the only line of business with specific working conditions. However, in the case of other sectors, bridging pensions were introduced (excluding new employees, who enter the general pension system). The right to early retirement is granted to people of the appropriate age (55 for women and 60 for men) who have 15 years of service, as well as a specific contribution payment period. These solutions apply for instance to metallurgy, railway transport, emergency medical services, or teachers.

THE IMPORTANCE OF THE
MINING SECTOR AND LARGE-
SCALE ENERGY GENERATION
AS THE SOURCE OF GROWTH
AND JOBS IS INEVITABLY
DECREASING

3.2. Diversification of industry and services

The importance of the mining sector and large-scale energy generation as the source of growth and jobs is inevitably decreasing. In this situation, reaching the level of GDP per capita and wages comparable with the industrial-service centres of Western Europe requires meeting two conditions. **The first is fast increase of productivity at a rate of at least 1.5-2% above the EU average. The second is significant diversification of the foundations for the development of the local economy.**

Maintaining the dynamics of economic development at the level described above would guarantee the prosperity of the inhabitants of the Silesian Voivodeship, i.e. reaching the EU average in approximately twenty to thirty years. However, this would have to be a broad process, not only concerning a few economic subsectors. Due to the specialisation of the region, a high level of growth of the manufacturing would be the priority. At the same time, the voivodeship needs both a significant increase (approximately 3 times by 2050) of the industrial value added, and a big increase in its diversity. Currently, the added value per capita generated in the Silesian manufacturing (approximately EUR 3,000 per inhabitant according to market rates) is 70% of the EU average, and 40% of its most industrialised parts. In services, the gap is bigger, which means that equalising the quality of life in 2050 requires the Silesian Voivodeship to triple the current industrialisation level in this time-frame, becoming one of the most industrially developed regions on the continent.

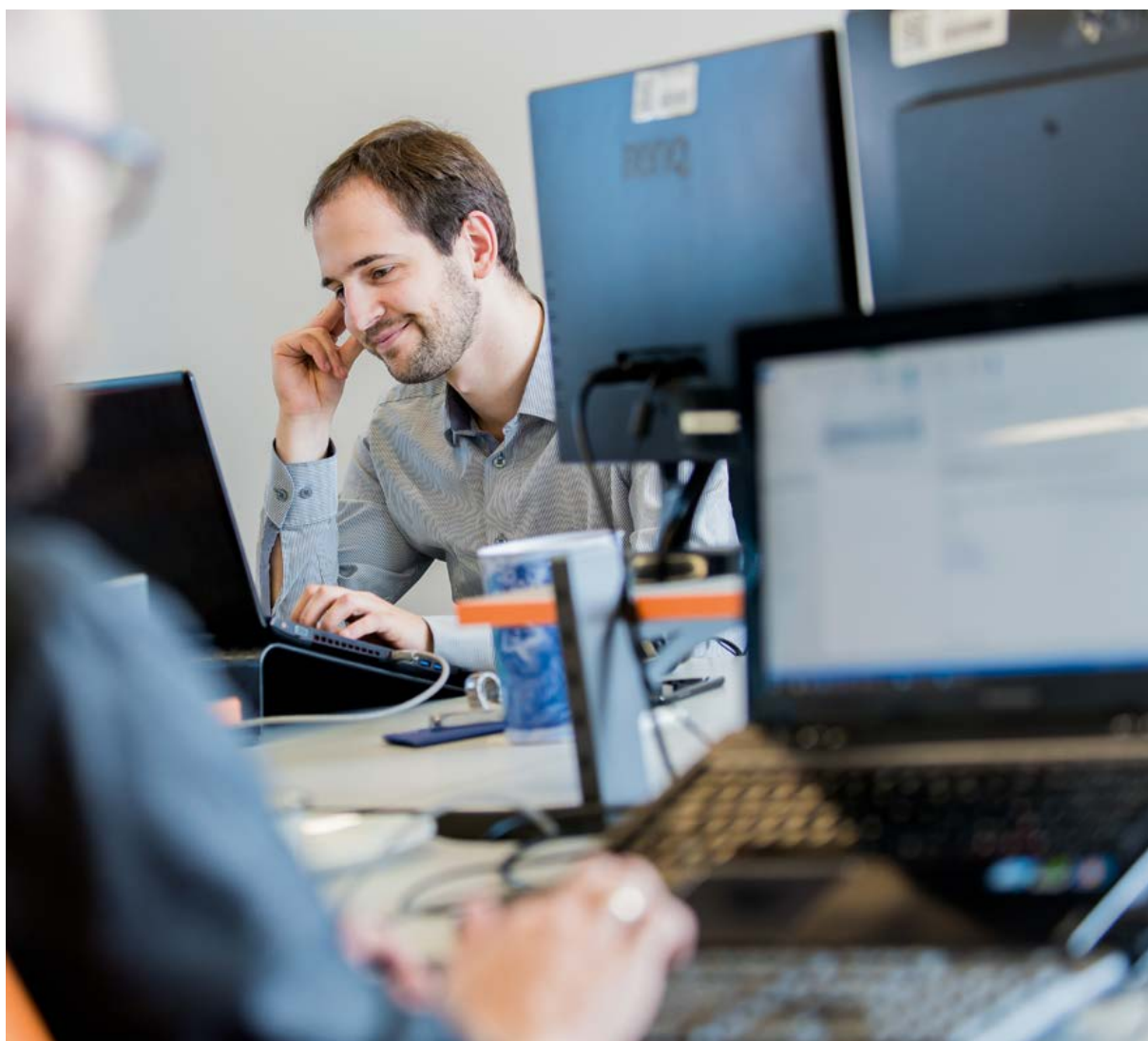
This will not be possible without attracting new branches of the manufacturing, and the gradual increase of complexity of the types of business activities dominating in the region. This requires the local authorities to work (together with the central government and its agencies) to attract to the region investors active in sectors that were hitherto under-represented, in particular in the machinery, electrotechnical and electronic, chemical, or pharmaceutical industries, at the same time developing the ones, which – like manufacturing vehicles and parts for them – are already well-developed in the region. In the second case, however, it is important to follow the technological changes taking place in the industry, as a result of which combustion engines in passenger cars will probably be replaced by hybrid, electric or hydrogen drives. If it does not re-profile the local production base in the automotive industry in time, the voivodeship may become one of the regions that will lose in the global transition of transportation.

At the same time, public policy should support companies in diversification of their activities and entering new markets, including global ones, without wasting resources on artificially maintaining the demand for solutions gradually losing their market position, such as conventional energy technologies. To do this, it is necessary to build foundations for long-term competitive advantages of the voivodeship, i.e. above all strengthen the research facilities supporting business, including in particular services

with the highest added value: R&D, engineering, architectural, consulting and ICT. The policy of attracting investments to the region should, therefore, strongly promote development of activities of this type, and the main cities of the Silesian metropolitan area should create conditions for development of this type of indigenous companies.

This means increasing the academic status of regional higher education institutions and research institutes, as well as reprofiling some of them towards the issues not connected directly with the mining sector. Additionally, vocational education centres, the aim of which should be looking for opportunities to use the competences of employees from sectors undergoing restructuring in new areas of business activity, must be strengthened. This way, Silesian Voivodeship has a chance to benefit from the creation of modern industrial commons, of industrial-service type, i.e. networks of close connections between the centres generating human, social, and physical capital.

IT IS NECESSARY TO BUILD FOUNDATIONS FOR LONG-TERM COMPETITIVE ADVANTAGES OF THE VOIVODESHIP, I.E. ABOVE ALL STRENGTHEN THE RESEARCH FACILITIES SUPPORTING BUSINESS, INCLUDING IN PARTICULAR SERVICES WITH THE HIGHEST ADDED VALUE: R&D, ENGINEERING, ARCHITECTURAL, CONSULTING AND ICT



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Box 6.

CAN “CLEAN COAL TECHNOLOGIES” BE A KEY FOR THE MODERNISATION OF THE SILESIAN ECONOMY?

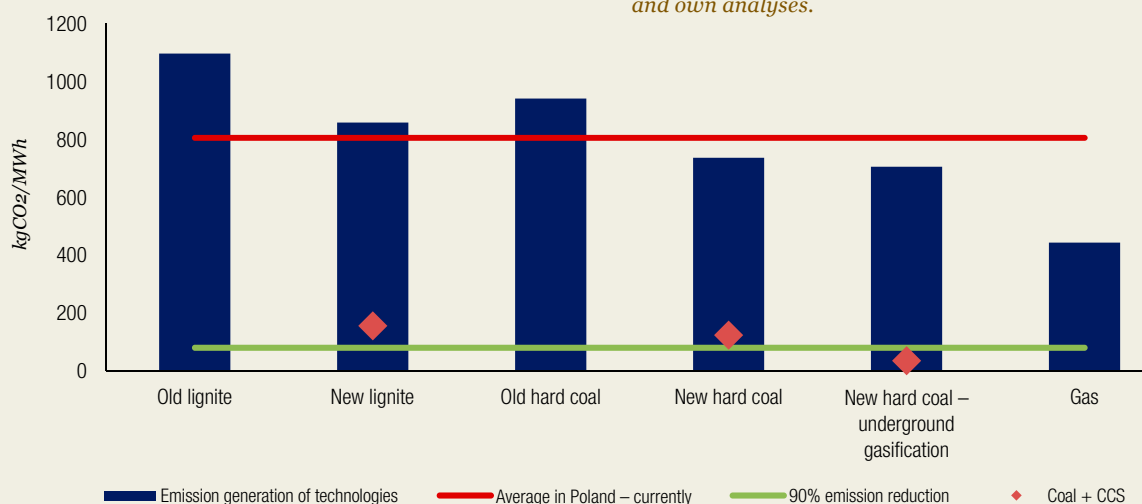
Government and regional strategic documents see the chance for hard coal in the so-called “clean coal” technologies, which are supposed to allow a significant share of the coal energy industry to be maintained in the Polish energy system, despite the growing requirements in the forms of climate policy and environmental standards. In this context, it is important to differentiate between the conventional technologies allowing only partial reduction of CO₂ emissions thanks to the improvement of fuel combustion efficiency, thus not solving the problem of emission costs in the medium and long term, and CCS (Carbon Capture and Storage) technologies, which are the only technological solutions ensuring significant reduction of emissions from the use of coal in the energy sector and industry. Both the above-ground and underground gasification of hard coal does not lead to eliminating CO₂ emissions. Instead, it increases the costs of electricity or synthetic fuels made of coal with the price of EU ETS allowances at EUR 15-20/t of CO₂ (see Ściążko et al. 2006). Reconciling coal gasification

on a large scale (without using CCS installations) with maintaining climate neutrality throughout the whole economy is, therefore, not possible.

CCS technologies are currently at an early stage of development, and are characterised by high costs, lack of social acceptance, and unidentified technical risks, which can call into question their practical applicability in the geological conditions of Silesia. An impassable barrier for the CCS technologies, however, might be economic factors alone. Power plants with CCS systems will probably have to operate in a baseload in order to achieve satisfactory cost-effectiveness. Taking into consideration the decrease in the costs of renewable energy sources, it is unlikely, however, that maintaining this type of power plants would be an optimal system solution. Evolution of the energy system is going rather in the direction of maximum utilisation of a large volume of cheap energy from renewable energy sources, at the same time balancing it with conventional power plants based on gas (initially) and energy storage (in the future), or power-to-gas solutions. This does not

Figure 34. Technologies of producing electricity from fossil fuels and the long-term climate goals

Source: WiseEuropa based on the data from the National Centre for Emissions Management, Hyder et al. (2014), and own analyses.



mean that the CCS-type solutions will not find their niche in the system, however, this may greatly be dependent either on the local geological conditions and acceptance by local communities, or on popularisation of the technologies that are currently in the early stage of development.

A potential decision regarding the development of nuclear energy in Poland would also decrease the chances for implementation of coal-based solutions in combination with CCS, as its place in the system would be at the expense of both coal and renewable energy sources.



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Therefore, developing the “clean coal” technologies should not be treated as the obvious way for maintaining the coal power plants in the Polish energy system until 2050. Due to the direction of both the global trends and the European energy and climate policy, and also the competition from more socially acceptable alternatives, putting faith in the relatively high-cost and risky technologies might not be the right path to take. At the same time, with the reduction of coal extraction spread

over 20-30 years, the technological reconstruction of the Polish energy industry towards sources not requiring import of fossil fuels becomes a highly justified alternative not only for the whole country, but also for Silesia. It enables a gradual reconstruction of the local economic model at a pace adjusted, on one hand, to the restructuring of the industrial base of the region towards non-energy-intensive sectors, and, on the other hand, towards the shaping of modern economy based on high quality services in the area.

Box 7. LESSONS FROM TRANSITIONS OF THE TRADITIONAL INDUSTRIAL REGIONS IN EUROPE AND NORTH AMERICA

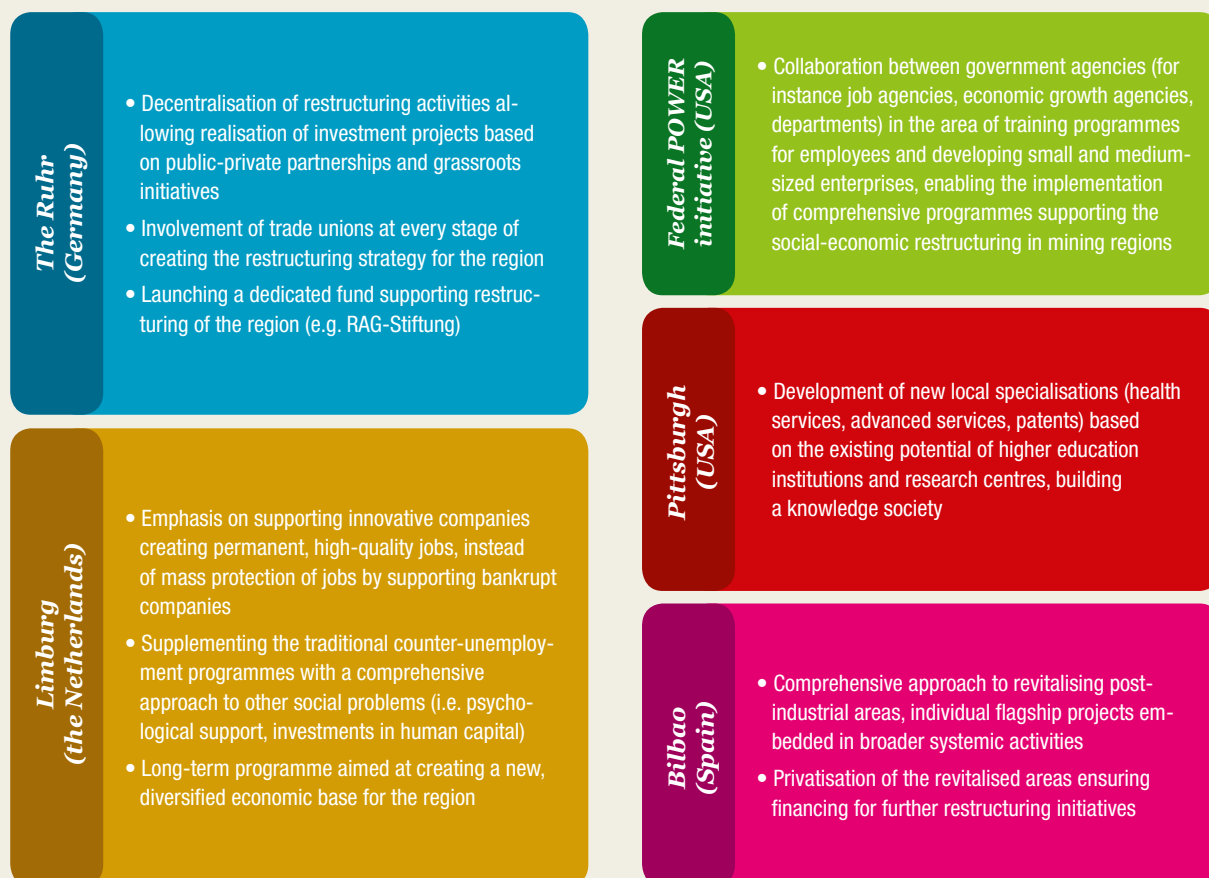
Examples from abroad indicate that an efficient transition of the traditional heavy industry regions is a long-term process made up of many stages. The increasing foreign competition, the growing intensity of production of alternative raw materials, more efficient energy-saving technologies, and the decreasing costs of generating energy from renewable energy sources have forced the developed economies to move from heavy industry to technology-related sectors.

Successful restructuring required cooperation of the central and local authorities and involvement of the private sector. A significant element of the transition was consistent sector diversification conducted by revitalising post-industrial

areas and adjusting them to the requirements of modern production systems at the same time. This required developing and implementing all-embracing development strategies combining the elements of development policy, labour market policy, and social policy. Responsible transition usually required agreements with trade unions based on the principle of giving people affected by restructuring of declining industries opportunities to gain the qualifications sought after in the market. This especially applies to people working in the so-called supporting services, i.e. mostly long-term administration employees of mining companies.

Diagram 4. *The best practices in the transitions of traditional industrial regions*

Source: WiseEuropa.



3.3. Cross-cutting actions

Revitalisation of urban space

Increasing the scale and comprehensiveness of the programmes focused on revitalising areas of degradation that are implemented in the Silesian Voivodeship is intended to provide systemic support for the regional economic development by raising the quality of life in the region and strengthening social cohesion in the area. It is difficult to expect the region's potential to be put to full use without improvement in these areas:

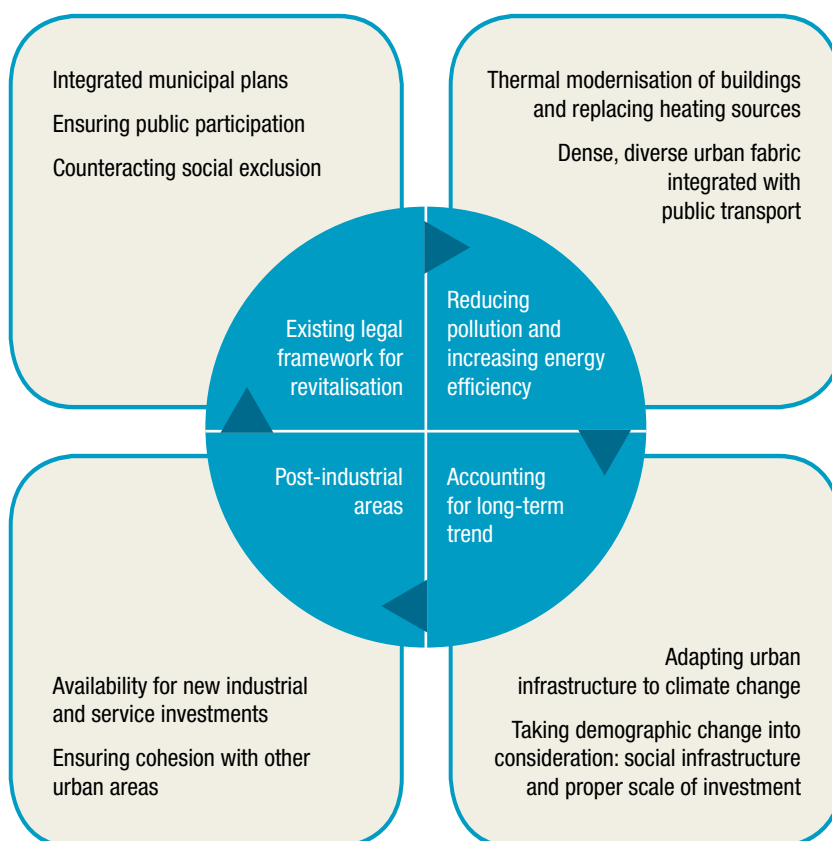
- investment: rapid increase of added value per employee,
- demographics: stopping population ageing processes and the decline of the number of region inhabitants,
- innovation: creation of a large number of R&D centres with European reach in the region.

In recent years, a regulatory framework (act on revitalisation of 2015) has been developed, enabling detailed planning of revitalisation measures and including local communities in the process. They encourage the voivodeship authorities to conduct a development-oriented policy in combination with meeting the needs and receiving opinions of the inhabitants of Upper Silesia, however, they do not emphasise the key dimension of revitalisation, i.e. the improvement of energy efficiency and reduction of pollution emissions in renovated buildings. Individual local authorities must be aware, however, of the value of taking measures that go beyond simple building renovation or even replacement of the local energy infrastructure. The optimum model of revitalisation in Silesian cities should include designing urban space in a way which

THE OPTIMUM MODEL OF REVITALISATION IN SILESIA CITIES SHOULD INCLUDE DESIGNING URBAN SPACE IN A WAY WHICH INCREASES THE ENERGY EFFICIENCY OF THE WHOLE CITY: CREATING A DENSE, DIVERSE URBAN FABRIC CONNECTED BY EFFICIENT PUBLIC TRANSPORT

Diagram 5. The elements needed for a comprehensive revitalisation of Silesian cities

Source: WiseEuropa.



increases the energy efficiency of the whole city: creating a dense, diverse urban fabric connected by efficient public transport⁴.

Comprehensive revitalisation must also include supralocal challenges, such as the necessity of adapting urban infrastructure to the requirements of climate policy (by means of developing for instance railway and bicycle transport, intermodality, and integration of various means of transportation), inclusion of demographic changes, or the continuing fast progress of digitalisation, requiring not only investments in fibre optic networks, but also implementation of digital technologies in all the municipal and transportation subsystems. In the case of the Silesian Voivodeship, the inclusion of post-industrial areas into the urban fabric will be very important. The business centres built there – just as the revitalised housing districts – must take into consideration the capabilities of the energy and transportation infrastructure of the city without generating adverse external effects: air pollution, excessive noise, or traffic congestion.

These issues should be reflected in municipal revitalisation programmes, especially in the case of mining municipalities. Therefore, it is necessary to increase awareness and popularise the knowledge regarding best practices in this respect among local government employees using specially designed training programmes directed at local authorities, and exchanging experiences with the representatives of local authorities from other European regions dealing with the problem of revitalising post-mining areas, for instance as part of the European platform for coal regions. It is also worth combining revitalisation activities with projects aimed at implementing systemic innovations realised in the EU programmes (Horizon 2020, Interreg Central Europe, Climate-KIC).

The region currently has many projects and initiatives in this respect, and is trying to obtain subsidies for this purpose as part of the initiatives mentioned above. However, the problem seems to be supporting revitalisation processes at national level, taking into consideration the specificity of the Silesian Voivodeship, i.e. enabling development of uninhabited post-industrial areas with significant environmental degradation as well as post-railway areas. These areas should have the possibility of being included in the revitalisation area, provided that they are transformed in accordance with social or economic goals of revitalisation programme, and the areas should not be included in the 20% limitation of the municipality area, which by law is the maximum revitalisation area. Worthwhile support for the region would also be the possibility of granting additional preferences or guarantees (apart from the existing support instruments in Special Economic Zone) for entrepreneurs investing in post-industrial areas, requiring increased investments or generating higher investment risk (mining-related damage). Currently, investors do not get sufficient incentives to incur additional costs and organisational efforts of developing projects in areas of degradation.

**COMPREHENSIVE
REVITALISATION MUST
ALSO INCLUDE SUPRALocal
CHALLENGES, SUCH AS THE
NECESSITY OF ADAPTING
URBAN INFRASTRUCTURE
TO THE REQUIREMENTS OF
CLIMATE POLICY**

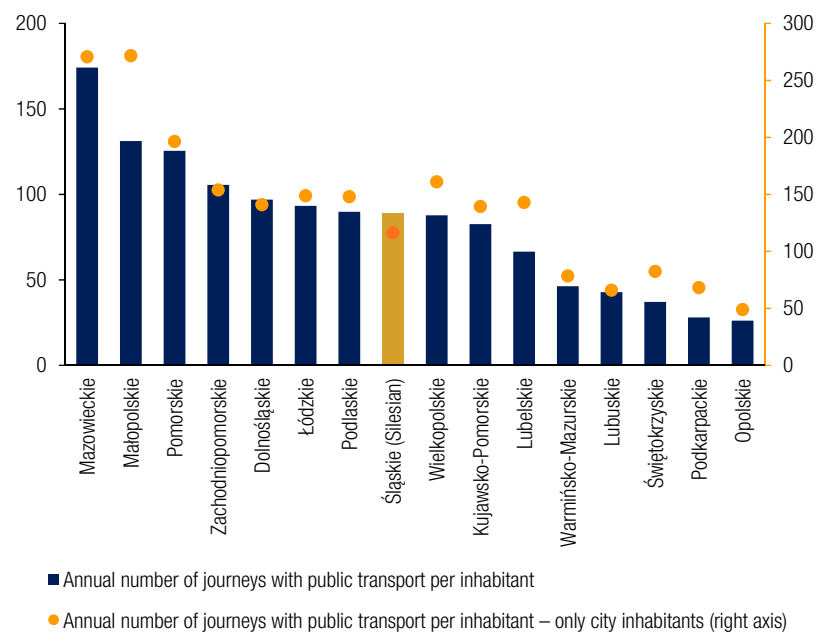
⁴ One of the projects dedicated to the topic of energy-efficient and resource-based revitalization of Polish cities is the REVIPOWER project (<https://efficient-city.org/>).

Public transport

The quality of life in the Silesian metropolitan area also depends on the way its inhabitants can meet their transportation needs. Despite a very high level of urbanisation, the region has average – in comparison to the rest of the country – intensity of public transport, falling clearly behind not only the Warsaw metropolitan area – another region in Poland with a large, multi-million population and high population density – but also Małopolskie Voivodeship or for instance the Tri-City. Silesian public transport is dominated by bus transport, with visible underdevelopment of railway transport: the number of seats in trams per voivodeship inhabitant is several times lower for example than in the Małopolskie Voivodeship, Wielkopolskie Voivodeship, the Łódzkie Voivodeship, or Mazowieckie Voivodeship. Only in Tychy is public transport high on the list of priorities of local authorities – in most of the other cities that are part of Silesian agglomeration, the transportation expenses of the local authorities are clearly lower than the amounts reported in other parts of the country. This situation affects first of all the accessibility of individual parts of the voivodeship for its inhabitants, and therefore the attractiveness of living and conducting business activities in the key centres included in the Silesian metropolitan area. Secondly, it affects the underdevelopment of public transport, especially railway transport, affecting the quality of air in the region and adding to the industrial and municipal pollution. Raising the investment attractiveness of the regions will, therefore, require solving transportation problems together with the problem of revitalising urban fabric and recultivation of post-mining and post-industrial areas.

Figure 35. Public transport passengers in Polish voivodeships in 2017 per capita

Source: WiseEuropa based on the data from Central Statistical Office.





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THE SHARE OF EXPENSES FOR PUBLIC TRANSPORT IN UPPER SILESIA IS MUCH LOWER THAN IN THE LARGEST POLISH CITIES

First of all, this means a need to increase public spending on public transport in the newly created Metropolitan Association of Upper Silesia and Dąbrowa Basin and in the other cities of the region – currently, both the scale of expenditure for this purpose and the share of expenditure in city budgets in the Silesian Voivodeship is significantly below the levels of the largest Polish cities. Emphasis should be put on: providing more bicycle pathways and increasing accessibility of this means of transportation to the inhabitants, development of railway transport infrastructure, modernising the fleet (including buses) with energy-saving and electric vehicles, greater co-funding of the costs of public transport resulting in increased availability (frequency) of runs, and the level of coverage of the urban area, so that the relative attractiveness of public transport increases significantly in comparison to private transportation. Also, coordination of the development of the public transport network within the metropolitan area (between cities) and making it consistent with railway transport run by Silesian Railways has to be much better than today. This concerns in particular the need for a more polycentric network of connections, not only converging in Katowice, but also connecting other urban centres. The goal should be to reduce passenger car traffic, also in the long term, when combustion engine vehicles will be replaced by electric ones, and, at the same time, to improve transport availability in individual parts of the Silesian metropolitan area in a way enabling greater efficiency of the local labour markets, reducing workforce shortages and decreasing the significant differences in the unemployment rate between neighbouring areas.

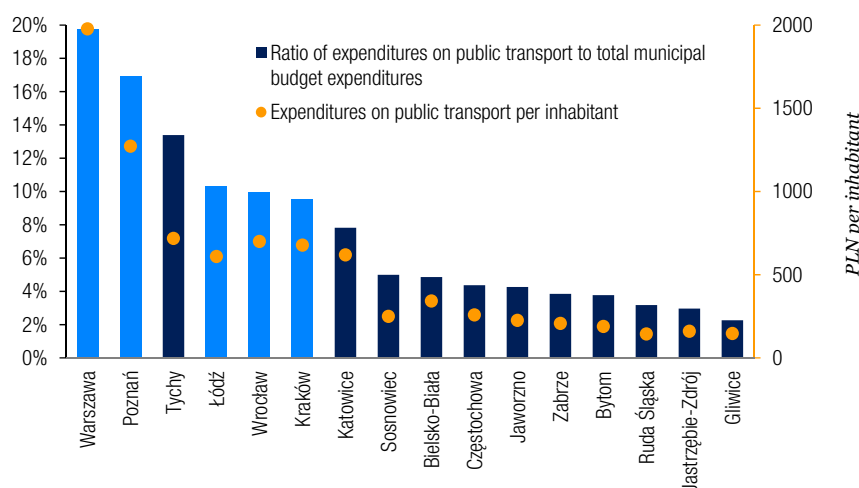


Figure 36. Public transport spending in selected cities in the Silesian Voivodeship and in the largest cities of Poland according to budget plans for 2018

Source: WiseEuropa based on budget resolutions.

3.4. Financing the modernisation

The need for infrastructure development and for strengthening the economic base concerns every Polish region. **A specific feature of the Silesian Voivodeship is the significance of the low-emission modernisation model for the future development of the local economy.** The success of the Silesian Voivodeship is closely connected to the prospects for improving the quality of life, and especially solving the problems of decapitalised urban and post-industrial fabric, a high level of air pollution, and low transport availability and quality of public services in the region. At the same time, the region must find the answer to the deteriorating position of the traditional branches of the mining sector and heavy industry, identifying new competitive advantages and attracting highly productive industrial and service investments.

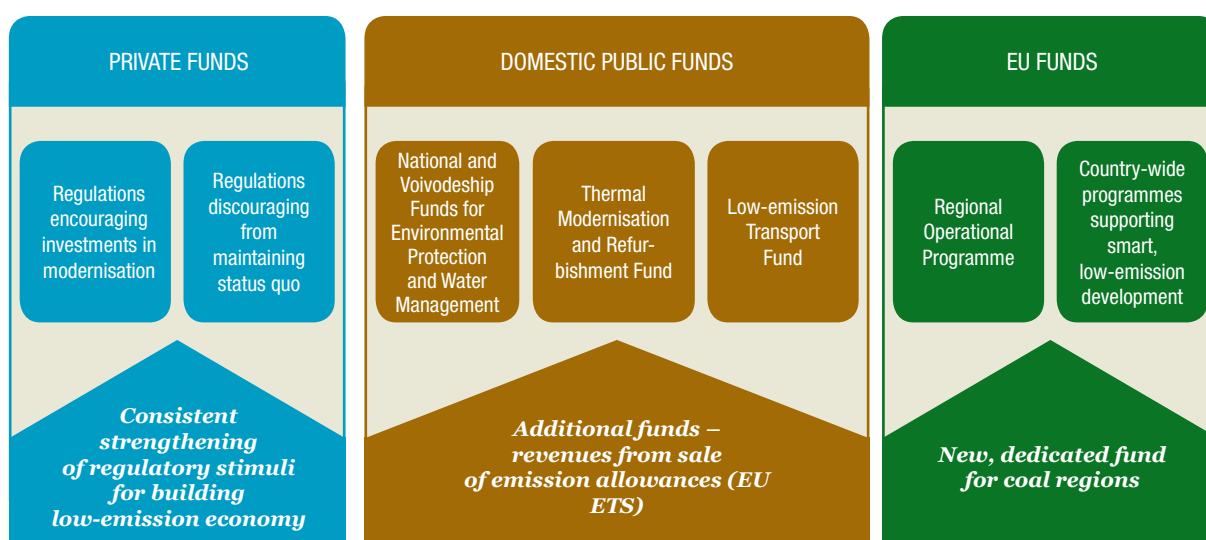
PUBLIC FUNDS WILL NOT BE ENOUGH TO COVER THE MODERNISATION NEEDS OF THE REGION

Diagram 6. Areas of public intervention for funding modernisation of the Silesian Voivodeship

Source: WiseEuropa.

The investment needs related to the systemic transition of the Silesian Voivodeship concern most of all revitalisation of post-mining areas, modernisation of municipal infrastructure, improvement of the air quality, transition of the local energy system, and also diversification of economic activities taking into account the necessity of restructuring declining industries and development of human capital adapted to the new type of economy. Mobilisation of the means for these goals shall be supported by the initiatives that take into consideration the recent evolution of financial markets. Effective mobilisation of funds adequate to the scale of modernisation challenges in the region requires combining various financial tools at regional, country and EU level, including the use of private funds and encouraging the private sector to get involved in projects of a more long-term nature. The focus on public funds, often dominant in the Polish development policy, including the financing from EU structural funds, is not enough to cover the modernisation needs of the region.

Sources for funding Upper Silesia's modernisation



In previous years, the possibility of public support for an investment in low-emission regional development, for instance in the form of regulatory tools, domestic environmental funds and EU funds, was gradually developed. **However, the existing solutions are still insufficient for the scale of adjustments awaiting the region. The key challenge is not only the improvement of the existing tools, but also directing additional public funds to the Silesian Voivodeship, to where they are needed the most.** At country level this means mostly the necessity of making decisions concerning:

- 1) **implementation of regulations accepting the necessity of major reduction of greenhouse gas emissions and air pollution** in such sectors as electricity and heat generation, buildings and transport, thus supporting the fast popularisation of low-emission energy sources in the regional energy balance, increasing energy efficiency and restructuring the fuel mix in buildings and industrial processes, as well as balancing the local transport system in the direction of low emissions, which will translate into significant improvement of the quality of air in the region;
- 2) **designating country-wide public funds generated from sale of allowances in the EU ETS system to co funding of low-emission investments in the region**, specifically concerning revitalisation and major thermal modernisation of the existing housing stock, recultivation of post-mining and post-industrial areas, and development of low-emission heating and zero-emission transportation (railway transport, gradual electrification of road transport).

The country-wide framework for financing low-emission investments in the key sectors should provide funds for the activities implemented at a local level – as with the EU operational programmes for the whole country. The projects realised in this way provide support for creating innovations and absorbing modern technologies by industry, accumulation of human capital among the people active in the labour market, and development of environmentally friendly infrastructure.

Implementation of activities at a country level is the necessary condition for the success of modernisation of the Silesian Voivodeship, however, it is not a sufficient condition for modernisation to proceed in a manner that takes into consideration the specific needs of the region and expectations of its inhabitants, as well as the companies conducting activities in the area. Due to the concentration of hard coal mining in the voivodeship and its main urban centres dealing with the negative environmental and infrastructural effects of traditional industry functioning in Upper Silesia, **it would be advisable to support the development processes with EU funds dedicated to coal regions in the next European Multiannual Financial Framework after 2020.**

**MODERNISING THE REGION
WILL REQUIRE MOBILISING
BOTH PRIVATE AND PUBLIC
FUNDING**

**THE DEVELOPMENT
OF COAL REGIONS SHOULD
BE SUPPORTED
BY A DEDICATED POOL
OF EU FUNDS**

**SUPPORT FOR MINING
CENTRES SHOULD ALLOW
FLEXIBLE SPENDING OF
THE FUNDS BASED ON THE
NEEDS IDENTIFIED
AT A LOCAL LEVEL**

With the pool of funds directed to European mining regions, distributed proportionally to the number of employees in the mining sectors, these regions – including the Silesian Voivodeship – would get better access to financing of their own modernisation initiatives, and the European Union would improve the visibility of the provided support, increasing acceptance for the changes brought by the climate and energy policy. At the same time, if such a tool were implemented in the whole of the EU it would facilitate information flow regarding best practices in utilising funds between European regions. The first steps in this direction have already been made by the European Commission by creating a Coal Regions in Transition Platform. Currently, this pilot project includes regions in Poland (Silesian Voivodeship), Slovakia (Trencin), and Greece (western Macedonia), however, its goal is to support the dialogue and popularise the expertise on just transition between all European mining and post-mining regions.

Support for mining centres should also allow flexible spending of the funds based on the needs identified at a local level, including modernisation investments going beyond the energy sector. The challenges faced by traditional industrial centres in Europe are systemic in nature (diversification of the economy, improvement of the quality of life), and every one of them has a different initial position. In the case of the Silesian Voivodeship, the area requiring additional modernisation effort is revitalisation of problematic post-industrial areas, taking into consideration major changes not only in energy infrastructure, but also in other municipal and network infrastructure (including digital networks).

Investments in these spheres will not only improve the quality of life in the region but also ensure proper conditions for the development of modern industry and services in the area. Comprehensive revitalisation investments are a chance to implement organisational innovations, new business models, and public services in a way unavailable for the areas without them. Modernisation projects implemented in cities and even in individual districts or housing estates can combine the elements of the traditional fuel and energy system (district heating, electricity generation transport, industry), and digital innovations (smart city or Industry 4.0 solutions). At the same time, the financial resources in a dedicated fund for mining regions should be supplemented by other support tools aimed at changing the industrial structure of the local economy, and professional activation of the current and past employees of the mining sector.



Table 5. Areas of modernisation investments in the Silesian Voivodeship, sources of their funding, and necessary decisions

Source: WiseEuropa.

Investment area	Key source of funding	Necessary decisions
Energy sector – network infrastructure and distributed, low-emission energy sources	Financial resources of companies and households, mobilised by a friendly regulatory environment	Country level: implementation of regulations that encourage cost-effective development of distributed energy generation, low-emission heating, modernisation of the electricity network, and expanding the district heating network
Buildings – housing	Private sector, supported by public subsidies and EU funds	Country level: country-wide programme with financial incentives for deep thermal modernisation of buildings (attaining high energy efficiency, complete elimination of the direct use of fossil fuels in buildings)
Buildings – public	EU funds, co-funding from domestic means and local authority budgets	Regional level: public buildings modernisation goals consistent with long-term goals of the EU (attaining high energy efficiency, complete elimination of the direct use of fossil fuels in buildings) Country and EU level: adequate funds enabling financing of high energy efficiency investments
Public transport	EU and domestic funds, co-funding from local authority budgets	Country level: development of public transport with emphasis on railway transport and zero-emission road transport as part of the Low-Emission Transport Fund
Traditional, emission- and energy-intensive industry	EU and domestic support for process innovations enabling major reduction of greenhouse gas emissions	Country level: rewarding R&D projects aimed at major reduction of process emissions, supporting domestic companies in applying for EU funds for this purpose
Other industry	Private funds supported by EU, domestic and regional co-funding for industrial commons and innovations	Regional level: focusing on sectoral diversification and using the existing advantages in new markets
Comprehensive revitalisation of post-industrial areas	EU funds, co-funding from domestic funds and local authority budgets	Regional level: emphasising the realisation of comprehensive infrastructural investments consistent with the smart, green city and Industry 4.0 concepts EU level: Creating a dedicated EU fund supporting mining regions
Training and professional activation	EU funds, co-funding from domestic funds and local authority budgets	Regional and country level: increased transparency of the plans for restructuring the mining sector, improved circulation of information regarding demand for employees in the sector, ensuring prompt preparation and implementation of measures aimed at the employees in the sector EU level: Creating a dedicated EU fund supporting mining regions

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4. CONCLUSIONS

A just transition of the Silesian Voivodeship is connected to three inter-linked challenges:

1. **Economic challenge**, equally as applicable to the region as other parts of Poland. It is based on raising – within three decades – the level of GDP per capita and productivity of labour in the voivodeship to that of the prosperous states of Western Europe. The other two challenges follow from the features shared by the regions with long industrial traditions dating back to the 19th century.
2. **Demographic challenge**, i.e. halting the decline in the number of the region's inhabitants and the intensive ageing process of the local population. This means stopping the problem of negative natural increase and replacing intensive emigration with influx of people to the voivodeship from other parts of Poland or from abroad.
3. **Social challenge**, which is to improve the quality of life. This requires solving the interconnected social and ecological problems in the region: the areas with high unemployment, poverty and increased crime, decapitalised housing and transportation infrastructure, or the very high level of air pollution.

These challenges mean major restructuring of the region's economy, especially accepting the inevitable reduction of the importance of hard coal mining, heavy industry and traditional, conventional energy industry. Even today, the scale of activities and influence of these sectors is much smaller than the way it is socially and politically perceived, and the current industrialisation of the Silesian Voivodeship is based on sectors unrelated to the energy-mining complex. The future will be similar, as in no other industrial region of Europe hard coal mining, heavy industry and the traditional energy industry plays an important economic role. On the contrary – they dominate only in poorly industrialised regions (e.g. Western Macedonia) or in areas using the deposits of other fuels, especially gas (e.g. Groningen). These regions, like the Silesian Voivodeship, however, are facing the problem of the decline of resources which are viable for economically justified exploitation.

In the Silesian Voivodeship, the decline of coal mining is taking place due to the geological problems overlapping with the fast-rising labour costs. This causes a gradual, but inevitable decrease of profitability of coal extraction, which will cause closure of the mines active today within two decades. **The chances for the so-called “clean coal technologies” to address this problem are low. Therefore, they should not be treated as one of the foundations of the region's industrialisation, but as one of the niches in the broad portfolio of future production specialisations at the most.** The technical solutions allowing major reduction of pollution emissions in the conventional energy sector are very costly, and unverified in large-scale

THE INEVITABILITY OF FURTHER RECONSTRUCTION OF THE REGION'S ECONOMIC STRUCTURE HAS TO BE ACCEPTED, SPECIFICALLY THE DECREASE OF THE SIGNIFICANCE OF HARD COAL MINING AND THE TRADITIONAL, CONVENTIONAL ENERGY INDUSTRY

CLEAN COAL TECHNOLOGIES ARE NOT THE SOLUTION TO THE PROBLEMS OF THE MINING INDUSTRY IN UPPER SILESIA

THE ECONOMIC GOAL OF THE DEVELOPMENTAL POLICY OF THE SILESIA VOIVODESHIP, BOTH THE ONE ADOPTED BY LOCAL AUTHORITIES, AND THE COUNTRY-WIDE INSTITUTIONS COLLABORATING WITH THEM, SHOULD BE THE SIGNIFICANT RECONSTRUCTION OF THE SECTORAL STRUCTURE OF THE REGIONAL ECONOMY, AND THE DEVELOPMENT OF NEW, MORE PRODUCTIVE, AND, AT THE SAME TIME, LOW-EMISSION TYPES OF BUSINESS ACTIVITIES WITHIN IT

operations, and their economic attractiveness in comparison to low-emission sources is limited.

Accepting this situation would mean that measures could be determined to support the smooth development of the Silesian Voivodeship, and, at the same time, the necessary transition in a way that will be sustainable and secure for the people employed in the mining industry.

The greatest developmental need of the regions is the diversification of the local industrial base with high-efficiency, low-emission manufacturing subsectors, such as the machinery, electrotechnical, chemical and pharmaceutical industries.

Also, the automotive industry, which is well-established in the region, and, similarly to the whole of Europe needs to change, will have to undergo major technological transition guaranteeing almost full reduction of transport emissions by 2050. The Silesian Voivodeship has an opportunity in this respect to attract investments that are aligned with the needs for production of electric, hybrid or hydrogen vehicles, both in the sphere of final production (passenger cars, trucks, buses, trains, etc.) and of components and their parts (batteries, fuel cells, electric and hybrid engines, etc.). Also, the other sectors facing the necessity of low-emission transition can provide an important developmental impulse for the Silesian Voivodeship:

- **energy industry** – by expanding supply chains in the region using low-emission technologies producing energy from renewable sources,
- **heavy industry** – thanks to the implementation of qualitative changes in production processes consistent with the long-term climate goals of the European Union.

The industry policy and the measures to the transition of sensitive sectors should be complemented with the creation of conditions for service sector growth, especially in its more advanced segments: engineering, IT, medical, and consulting services. This requires not only actively seeking investments in these areas, but also measures to help shape high-quality human capital in the region, including the development of higher education and a scientific and research & development base in the region in the direction consistent with the needs of the industry and modern services. Support for innovation should also promote increased international competitiveness of the local higher education institutions and research institutes, and flow to the projects not connected to mining and traditional energy industry, or support only measures with a real chance of significant reduction of emissions and broad application of the developed technologies on a global scale (e.g. in the case of reducing emissions associated with using coke in metallurgy).

To sum up, the economic goal of the developmental policy of the Silesian Voivodeship, both the one adopted by local authorities, and the country-wide institutions collaborating with them, should be the significant reconstruction of the sectoral structure of the regional economy, and the development of new, more productive, and, at the same time, low-emission types of business activities within it. Measures that are strictly economic should at the same time find strong support in the initiatives taken up in other areas. This is especially true for projects

changing the nature of municipal and transportation infrastructure in the region. Because of a significant increase in the investments in thermal modernisation of buildings and replacement of heating sources, it is possible not only to significantly improve the quality of life in the Silesian Voivodeship, greatly decreasing the problem of air pollution in the Silesian cities, but also to support the expansion of the supply chain in a way that makes a large contribution to the local labour market and economy. Meanwhile, increasing spending on development and standardisation of public transport in the region (especially rail transport) would make it possible to integrate local labour markets, decreasing the problem of the significant differences in the unemployment and poverty rates between the neighbouring municipalities of the Silesian metropolitan area. In order for this to happen, the revitalisation of the urban fabric and expansion and standardisation of the regional system of public transport should be accompanied by actions in the sphere of labour market policy, allowing people who lose their jobs in sectors undergoing restructuring or living in the most problematic parts of the metropolitan area to gain new qualifications.

THE ECONOMIC GOAL OF THE SILESIA DEVELOPMENT POLICY SHOULD BE THE SIGNIFICANT RECONSTRUCTION OF THE SECTORAL STRUCTURE OF THE REGIONAL ECONOMY AND THE DEVELOPMENT OF NEW, MORE PRODUCTIVE, AND LOW-EMISSION TYPES OF BUSINESS ACTIVITIES

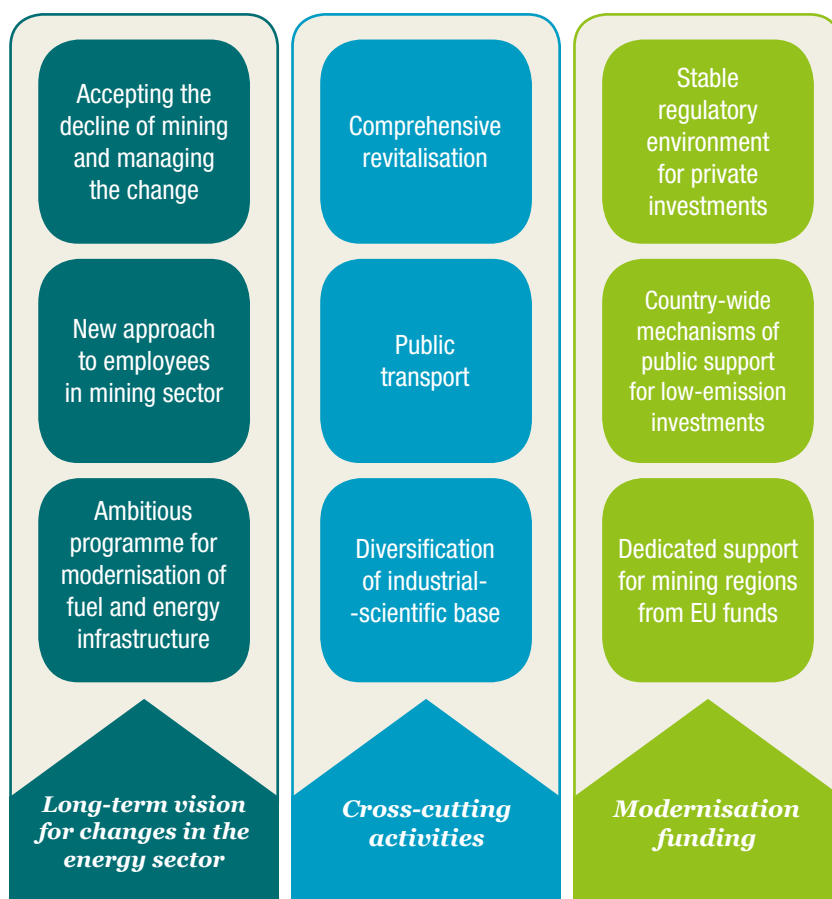


Diagram 7. Key areas of measures to ensure sustainable development of Upper Silesia in the 21st century

Source: WiseEuropa.

The causes of the demographic and social problems of the Silesian Voivodeship can be found in the environmental and economic legacy of the mining industry and heavy industry. Therefore, an integrated developmental policy focused on attracting modern investments and comprehensive improvement of the standard of living in the region by revitalising the urban fabric and post-industrial areas, improving the availability and the standard of transport services, and significantly reducing emission of pollution and the intensity of mining-related damage, will increase the attractiveness of the Silesian Voivodeship as a place to live on the country's map. Together with an active policy of the local authorities promoting the influx of people into the region from other parts of Poland or from abroad, this would make it possible to maintain the strength of the regional labour market, even with the ageing of its demographic structure.

Measures at voivodeship level must be supported by domestic and EU policies. Specifically, just transition in the region requires a **country-wide framework for the key sectors** (energy, buildings, transport, industry), which would ensure the means for investments supporting restructuring and revitalisation of the region, using not only public, but also private funds. Additionally, the state's support is **necessary for the inclusion of energy and mining companies in the process of just transition.** This should be accompanied by changes to the rules of social insurance for the people employed in mining, facilitating the move from this sector to other sectors, as well as changing the profile of operations of mining companies.

Financing modernisation will require legislative amendments at a country level, mobilising private funds, and also effective combination of public sources of funding at the regional, country and EU level, including **the dedicated European fund supporting the transition of mining regions.** Only the combination of regulatory amendments favouring the constant development of the Silesian Voivodeship with adequate financial support using public funds can ensure the constant increase in the competitiveness of the region's economy and the improvement of the quality of life, at the same time limiting the social costs of the restructuring process.

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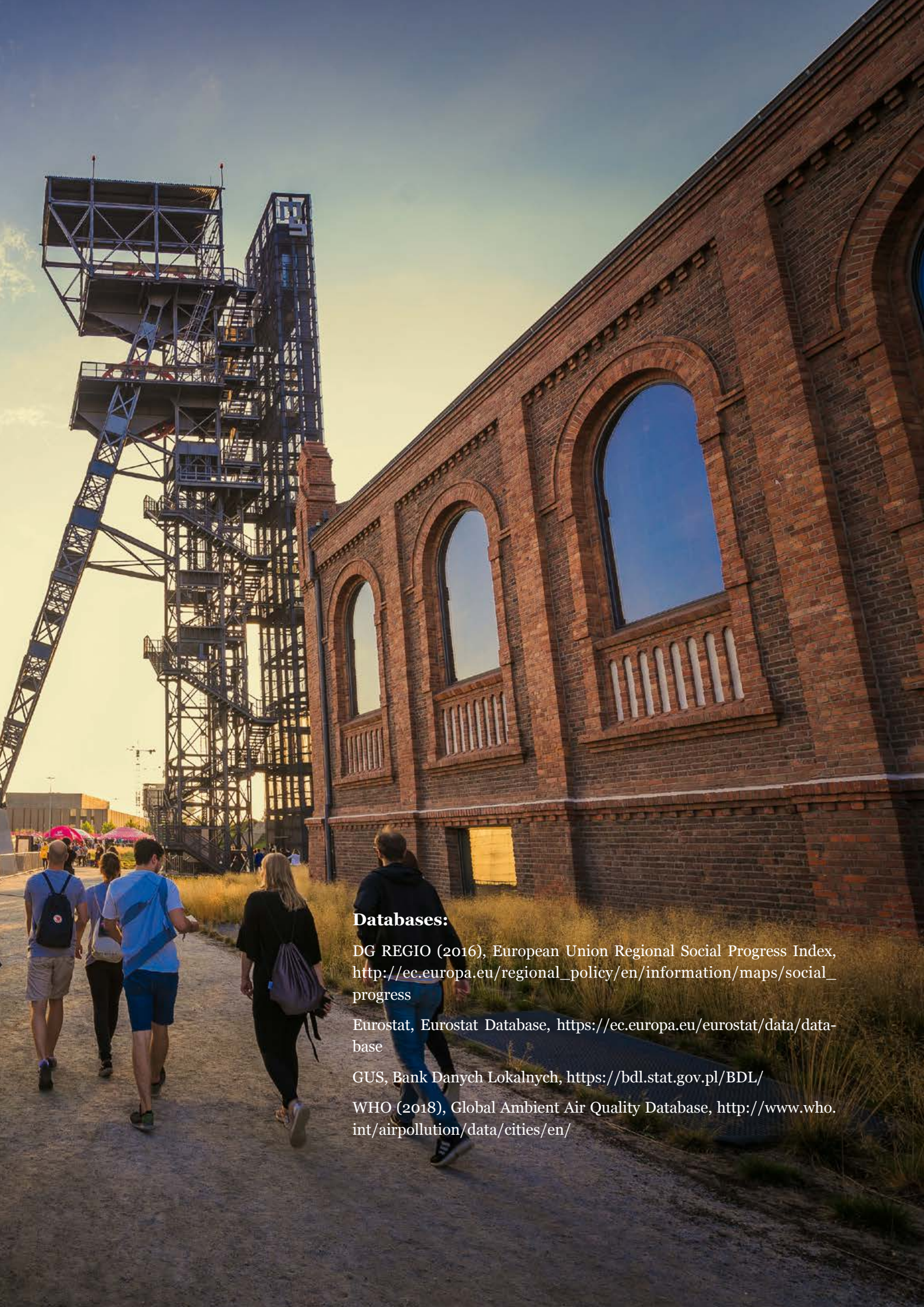
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KEY RECOMMENDATIONS

THE INDUSTRY

A diversified and competitive industry providing low-emission solutions for the European and global markets

THE ENVIRONMENT

Deep changes in the fuel and energy supply system are needed on the way to clean air and a low-emission economy

SPATIAL ASPECT

A complex redevelopment including the improvement in energy efficiency and means of public transport

PEOPLE

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