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**JUST ENERGY TRANSITION IN WESTERN UKRAINE'S COAL MICRO-REGIONS: PATHWAYS TO SUSTAINABLE DEVELOPMENT**

*The article examines the problems and prospects of implementing the 'green' transformation of coal micro-regions of the Ukrainian-Polish borderland. The purpose of the study is to identify key challenges and threats to micro-regions in the context of economic decarbonization, as well as to identify ways to intensify the processes of equitable transformation, taking into account European standards and strategies. The article identifies the characteristic features of the socio-economic status of coal micro-regions, among which the key ones are the dependence of economies on the extractive industry, low innovation activity and limited employment in high-tech sectors. It is revealed that the transformation processes are accompanied by such challenges as job losses, loss of financial capacity of communities and limited integration into new economic models. The article outlines the directions of preserving the level of economic development of micro-regions of the Ukrainian-Polish borderland in the context of closure of coal enterprises: diversification of economic activity, development of renewable energy sources, improvement of mechanisms of state support and attraction of international resources.*

**Keywords:** *Lviv-Volyn Coal Basin, just transformation of coal micro-regions, territorial communities, coal mining and energy enterprises, mine closures, war.*

**Сторонянська І. З., Патицька Х. О., Дуб А. Р., Беновська Л. Я., Нестор О. Ю. СПРАВЕДЛИВА ЕНЕРГЕТИЧНА ТРАНСФОРМАЦІЯ ЗАХІДНОУКРАЇНСЬКИХ ВУГІЛЬНИХ МІКРОРЕГІОНІВ: ШЛЯХИ ДО СТАЛОГО РОЗВИТКУ**

*Розглянуто проблеми та перспективи реалізації «зеленої» трансформації вугільних мікрорегіонів українсько-польського прикордоння. Виявлено головні виклики та загрози для мікрорегіонів в умовах декарбонізації економіки, а також визначено напрями активізації процесів справедливої трансформації, ураховуючи європейські стандарти та стратегії. Дослідження зосереджується на визначенні ключових перешкод для сталого розвитку, оцінюванні соціально-економічного впливу реструктуризації вугільної промисловості та розробленні пропозицій стосовно механізмів прискорення переходу до низьковуглецевої*

## СОЦІАЛЬНО-ЕКОНОМІЧНІ ПРОБЛЕМИ СУЧАСНОГО ПЕРІОДУ УКРАЇНИ

економіки. Оцінено роль політики ЄС та національної політики, фінансових інструментів і трансграничного співробітництва у сприянні трансформації. Використано системний аналіз і емпіричні дані щодо економічної, соціальної та екологічної складових функціонування вугільних мікрорегіонів. Проведено порівняльний аналіз з європейськими практиками трансформації, що базуються на стратегіях Європейського зеленого курсу, зокрема у сфері декарбонізації, інноваційного розвитку та адаптації до змін клімату. Визначено характерні особливості соціально-економічного стану вугільних мікрорегіонів, серед яких провідними є залежність економік від добувної промисловості, низька інноваційна активність та обмеженість зайнятості у високотехнологічних секторах. Виявлено, що трансформаційні процеси супроводжуються скороченням робочих місць, утратою фінансової спроможності громад та обмеженою інтеграцією до нових економічних моделей. Окреслено напрями збереження рівня економічного розвитку мікрорегіонів українсько-польського кордону в умовах закриття вугільних підприємств: диверсифікація економічної діяльності, розвиток відновлюваних джерел енергії, удосконалення механізмів державної підтримки та залучення міжнародних ресурсів. Запропоновано рекомендації щодо інтеграції місцевих стратегій розвитку до загальнонаціональних та європейських програм через упровадження інструментів справедливої трансформації. Основні напрями підтримки та стимулювання рівня економічного розвитку мікрорегіонів українсько-польського кордону в контексті закриття вугільних підприємств: 1) збереження та розвиток демографічного потенціалу територій, що справляє значний вплив на соціально-економічні тенденції мікрорегіонів через розвиток місцевого ринку праці, активізацію взаємодії з молоддю, реформу системи спеціалізованої освіти в мікрорегіонах, перепрофілювання та підтримку шахтарів у працевлаштуванні, залучення ВПО (зокрема сімей з дітьми) та інтеграцію їх у соціально-економічне життя громад; 2) розвиток конкурентного економічного середовища в мікрорегіонах. Результати дослідження можуть бути використані для розроблення стратегічних планів і програм розвитку вугільних мікрорегіонів, спрямованих на забезпечення інтеграції їх в економіку регіону та держави в умовах курсу на декарбонізацію. Практичне впровадження запропонованих заходів дасть змогу забезпечити економічну стійкість громад, мінімізувати негативні соціальні наслідки закриття шахт і сприяти переходу до екологічно безпечних моделей виробництва та споживання.

**Ключові слова:** Львівсько-Волинський вугільний басейн, справедлива трансформація вугільних мікрорегіонів, територіальні громади, підприємства вуглевидобування та енергетики, закриття шахт, війна.

**Problem statement.** Despite the growing geopolitical tensions in the world, the energy transition is one of the key challenges for the EU countries, which have set themselves the ambitious task of a sustainable transition to climate neutrality across Europe by 2050 [1; 2]. To achieve this goal, the EU is actively implementing innovations in the governance system:

1) strategic and other conceptual documents with a planning horizon of 2030 and 2050 are being developed (EU Biodiversity Strategy 2030, EU Forest Strategy, New EU Adaptation Strategy (for climate change), etc.);

2) the process of updating European legislation and regulations (European Climate Law, a package of laws under the common title «Fit for 55 package») was launched;

3) institutional environment is developing (EU system for emissions trading in energy, aviation, ships, and land transport, Carbon Border Adjustment Mechanism, Climate Social Fund);

4) the system of financial support for the implementation of the European Green Deal measures is being expanded (Just Transition Fund, improvement of the Eastern Partnership mechanism).

Despite the challenges of war, the state of Ukraine (under the EU-Ukraine Association Agreement, and then as a candidate country for EU membership) is developing in line with the European Green Deal [3]. On July 31, 2021, Ukraine's Nationally Determined Contribution was updated in the Register of Nationally Determined Contributions under the Paris Agreement [4] and a goal was set to reduce greenhouse gas emissions by 65% by 2030 (the previous goal – 40%) compared to 1990. This goal is being achieved in the context of intensifying cooperation between Ukraine and the EU through the implementation of numerous programs and projects at all

levels of the public administration system, attracting financial resources from EU funds, developing the institutional environment, and bringing the national legal framework in line with European legislation.

**Analysis of recent research.** The energy transition of coal regions is one of the important areas of the European Green Deal. Scientists emphasize that coal regions are the «starting points» for the regional energy transition in Europe in the institutional context and link this to the development of the EU on the basis of the European Coal and Steel Community [5].

A set of actions on the green transition resulted in the largest reduction in the share of fossil fuels in electricity production in United Europe: in January-June 2023, it was down to 33% compared to the same period of the previous year. Despite the war in Ukraine and the resulting energy crisis, which (as expected) could have led to a «coal comeback», «the largest decline was in coal power, when the share of the resource in EU electricity generation reached a historic low of less than 10% [6; 7].

Clearly identifying the connection between coal regions and old industrial areas, scholars emphasize their dependence on technological progress and an inherent problem of «deep specialization in long-established technologies and industries with little scope for further economic exploitation of knowledge». This «blocking» leads not only to economic, functional, political, and hierarchical isolation of the region but also to the consolidation of the worldview of economic actors [B, S, T], depriving them of creativity and imagination necessary for the development of new ideas and going «beyond» the usual [8]. Its consequences are evident in the lower level of socio-economic development of coal regions and communities compared to the average in the countries of which these regions are territorial units [9].

They are manifested in the following characteristics common to European coal regions:

- an industrial monostructure characterized by high capital intensity, barriers to entry to and exit from local markets, large size of coal companies, and oligopolistic market structure;
- significant influence of national and supranational institutions on the development of the leading sectors of the economy (primarily in energy, innovation, and industry);
- the presence of a clearly defined circle of stakeholders who are focused on preserving the position of the coal industry [10].

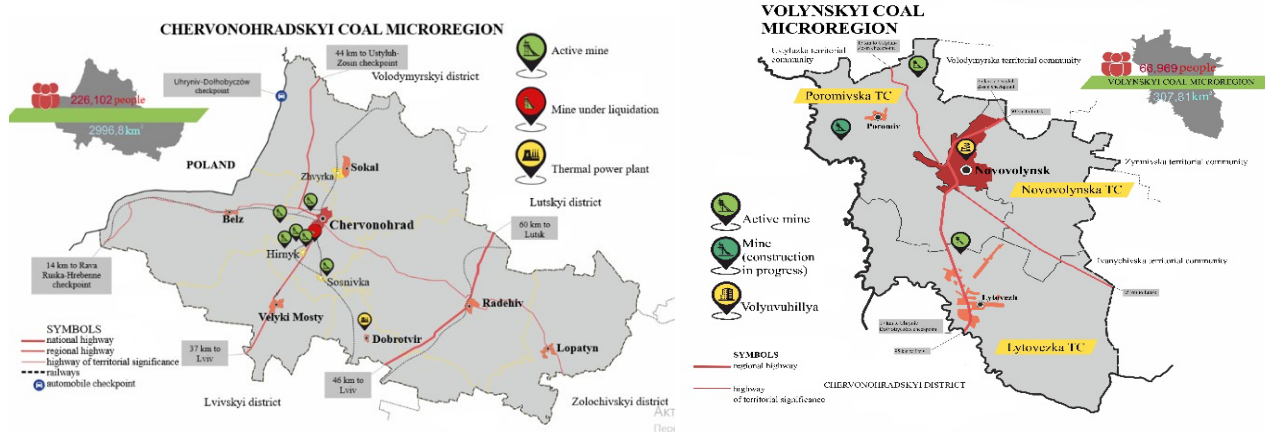
According to a study by the EU’s Joint Research Centre, regions and communities in Central and Eastern Europe will experience the most direct negative impacts of coal phase-out [9]. Although the Centre’s study does not cover the territory of Ukraine, unfavorable expectations are also inherent in coal microregions in our country, which face the same threats as coal regions in the EU.

**The paper purpose** is to analyze the challenges and prospects of the «green» transformation in coal-dependent microregions along the Ukrainian-Polish border. The research focuses on identifying key barriers to sustainable development, assessing the socio-economic impact of coal industry restructuring, and proposing mechanisms for accelerating the transition to a low-carbon economy. The objective includes evaluating the role of EU and national policies, financial instruments, and cross-border cooperation in facilitating the transformation.

**Major research findings.** The Lvivsko-Volynskiy coal basin located in the Ukrainian-Polish border area is a key center of coal production in western Ukraine. It consists of three coal-bearing areas: Novovolynskiy, Chervonohradskiy, and Southwestern. However, only two coal micro-regions have developed here: Chervonohradskiy in Lvivska oblast with the center in Chervonohrad and Volynskiy in Volynska oblast with the center in Novovolynsk (Fig. 1, Table 1).

Significant reserves of high-quality coal have been explored in the Lubelske and Tyaglivske coal deposits located within the Southwestern coal-bearing area (which lies within Lviv and Sheptytskyi districts). According to the results of geological exploration conducted between 1987 and 2017, the Lubelske deposit has been proven suitable for industrial development through the construction and operation of five coal mines. It is important to note that in the context of Russia’s full-scale aggression against Ukraine, these reserves could potentially serve as a replacement for coal lost from the occupied and decommissioned mines in Eastern Ukraine.

Substantial investments were made in the development of the «Lubelska» mines No. 1 and 2; however, coal extraction has not yet commenced. Thus, despite the presence of substantial high-grade coal reserves and significant economic potential, the formation of the Southwestern coal micro-region’s economy has not occurred. This is due to the absence of a coal mining cluster with an appropriate economic structure and labor market specialization in the region. Therefore, in line with the aim of the study, this article focuses on the Chervonohrad and Volyn coal micro-regions.



**Fig. 1. Maps of coal microregions of the Ukrainian-Polish border with the location of coal mining and power generation enterprises**

Source: compiled by the author based on [11; 12].

Table 1

**Characteristic features of Chervonohradskiy and Volynskiy coal microregions**

Indicator	Chervonohradskiy coal microregion	Volynskiy coal microregion
Area, km <sup>2</sup>	2 996.80	307.81
Population, persons	226,102	66,969
Location of territorial communities	Chervonohradska, Belzka, Velykomostivska, Dobrotvirska, Lopatynska, Radehivska, Sokalska	Novovolynska, Lytovezka, Poromivska
Number of settlements	205	32
Socio-economic centers of the microregion	Chervonohrad, Sokal, Radehiv	Novovolynsk

Source: compiled by the author based on [11; 12].

## СОЦІАЛЬНО-ЕКОНОМІЧНІ ПРОБЛЕМИ СУЧАСНОГО ПЕРІОДУ УКРАЇНИ

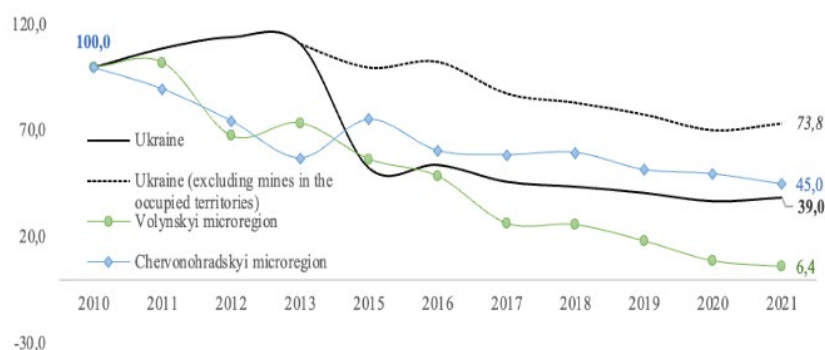
For decades, they have been and still are key industrial centers within the respective oblasts and the state fuel and energy complex, with specific employment and socio-economic development features inherent in them. However, just like the coal regions in the EU, they face the problem of specialization in outdated technologies and industries with low innovation capacity.

The economic specialization of the microregions of the Ukrainian-Polish border was formed at the beginning of the last century during the first exploration of coal deposits in Lvivsko-Volynskyi basin. From the mid-

twentieth century to the present day, their development has been directly connected to the mining industry.

The decline of the coal mining industry in Ukraine dates back to the 1990s and as of 2024 saw the closure of six out of 12 mines in Chervonohradskyi microregion (50%) and eight out of ten operating mines in Volynskyi coal microregion (80%). The economic situation of operating coal enterprises is difficult.

First of all, there is a rapid decline in coal production (Figure 2).



**Fig. 2. Comparison of the dynamics of coal production by Ukrainian mines and coal microregions of the Ukrainian-Polish border, 2010-2021, %**

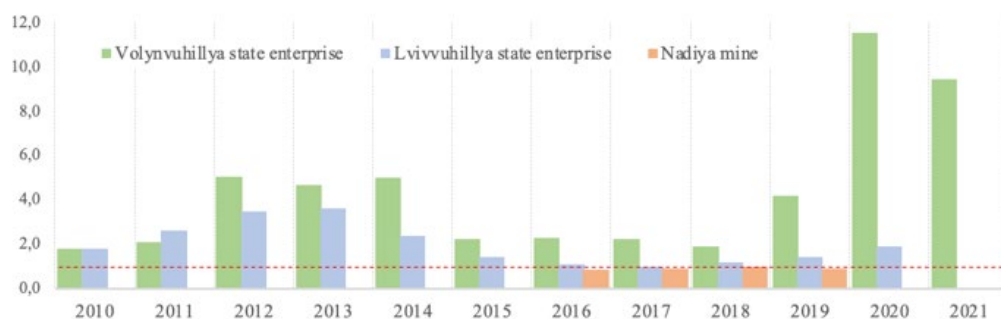
Note. Relative to the 2010 base year; Ukraine (excluding mines in the occupied territories) – for 2015-2021, 2015 was chosen as the base year.

Source: compiled by the author based on data [13].

While excluding the loss of mines in the territories occupied in 2014, the decline in the actual volume of coal mined in Ukraine in 2021 compared to the 2010 base year was 26.2%, the decline rate at the mines on the Ukrainian-Polish border was twice as high – 59.9%: in 2021, the mines of Chervonohradskyi coal microregion produced 39.0% of the actual volume of 2010, and Volynskyi coal microregion – only 6.4%.

Second, the problem is the long-lasting unprofitability of state-owned coal mining enterprises, which have operated for thirty years of Ukraine's independence using inefficient, outdated, and non-transparent management mechanisms. A clear indication of this is the constant

excess of the unit cost of finished coal products over the selling price at coal mining enterprises (Figure 3). Over the period 2010-2020, the cost of production at state enterprise LvivVuhillya was on average 1.6 times higher than its selling price, while at VolynVuhillya it was 4.3 times higher (with the difference having increased significantly in the last two years). Nadiya mine (100% owned by the state of Ukraine) was the only profitable coal mining enterprise within the coal microregions of the Ukrainian-Polish border. Still, even here the ratio of cost to selling price has been fluctuating around 1.0 since 2016.



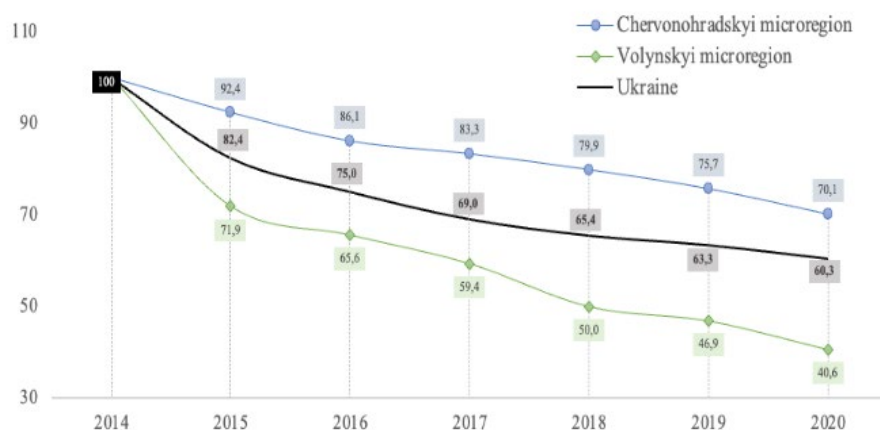
**Fig. 3. Dynamics of the ratio of the unit cost of finished coal products to their selling price at coal enterprises of the Ukrainian-Polish border in 2010-2021, times**

Source: compiled by the author based on data [15].

The increase in the cost of finished coal products is caused by a number of problems that result from (as mentioned above) inefficient management of state-owned enterprises in this area: the use of outdated equipment, lack of focus on the introduction of innovative mechanisms of coal mining and labor safety, low labor productivity of miners (50% of coal miners employed in state-owned mines in Ukraine produce only 10% of coal [14]), state restrictions on the cost of electricity, complexity of relations between market entities, etc. Amid the war and the missile threat to the infrastructure of the Ukrainian energy sector, the danger of coal mining enterprises losing their markets is becoming more urgent since coal produced in Lvivsko-Volynskiy coal basin is an

energy source. In particular, we are talking about the TPP in Dobrotvir, which before the war was one of the main places of sale of coal for microregions of western Ukraine, and as of 2024 is almost completely destroyed.

Third, the declining role of coal enterprises as key employers in local labor markets also indicates the decline of the industry (Figure 4). A steady decline in the number of employees is recorded at all mines and other separate divisions of coal companies. Moreover, while the decline in the number of employees in Chervonohradskiy microregion is slower than the average Ukrainian rate, the loss of jobs in Volynskiy microregion is much more intense: as of 2020, 40.6% of full-time employees remained at the industry's enterprises.



**Fig. 4. Comparison of the dynamics of the average number of full-time employees at enterprises in the mining industry of Ukraine and coal microregions of the Ukrainian-Polish border, 2014-2020, %**

Note. Against the 2014 base year.

Source: compiled by the author based on the data [16].

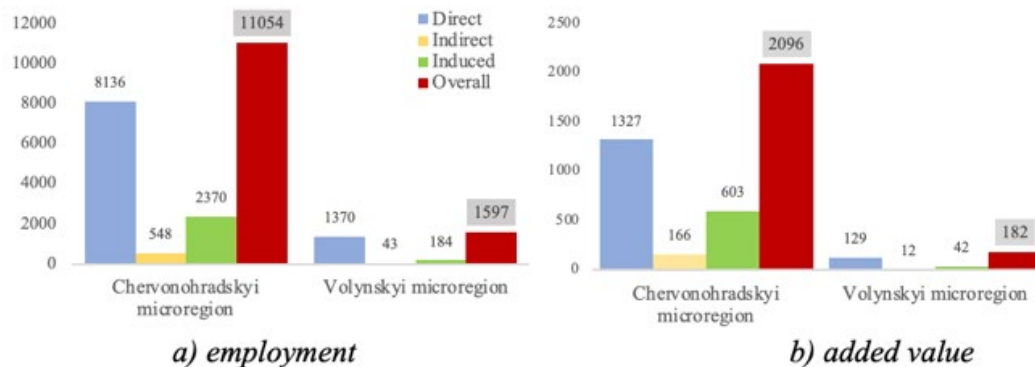
In general, the situation in coal mining in Ukraine is in line with the trends in the development of the coal sector in other countries (Germany, Czech Republic, Romania, Poland) and is characterized by a change in approaches to energy production towards the environmentalization of these processes.

Despite the long-term disappointing trends in the coal market, the economy of the communities of Chervonohradskiy and Volynskiy coal microregions is largely formed around the coal enterprises on their territory. According to DIW Econ GmbH [17], the functioning of the coal mining sector in the microregions of the Ukrainian-Polish border, along with direct effects (generated by the economic activities of coal companies), also has indirect effects (the impact of coal companies on the development of related sectors) and induced effects (those resulting from the spending of income of employees of coal enterprises and companies in related sectors).

Coal enterprises generate UAH 2.1 billion of value added in Lvivska oblast (0.8% of the total value added in the region) and UAH 182 million in Volynska oblast (0.2% of the total regional value added) (Figure 5, a).

It is worth mentioning that the direct economic effect plays a dominant role in the overall economic effect in both regions, which indicates a weak influence of the sector's enterprises on the development of regional economic sectors. According to experts [17], every UAH 1 of value added received by coal enterprises amounts to UAH 1.6 of value added in Lvivska oblast and UAH 1.4 in Volynska oblast, while in Dnipropetrovska oblast (where coal mines are privately owned) it is almost twice as much – UAH 2.3.

The coal mining sector has an impact on the creation of 11,000 jobs in Chervonohradskiy microregion and 1,500 in Volynskiy (Figure 5, b). Analyzing the role of the industry in the development of regional labor markets, we can see the predominance of direct effects and the limited indirect and induced effects: only about 3,000 jobs in Chervonohradskiy and more than 200 in Volynskiy microregions are the result of indirect impulses from the industry's enterprises. Therefore, we can state that a steady and intensive reduction in employment at coal enterprises is indeed accompanied by the risk of job losses not only at coal enterprises but also in other related areas, but this impact is limited.



**Fig. 5. Labor market effects of the coal mining sector in the coal microregions of the Ukrainian-Polish border, persons**

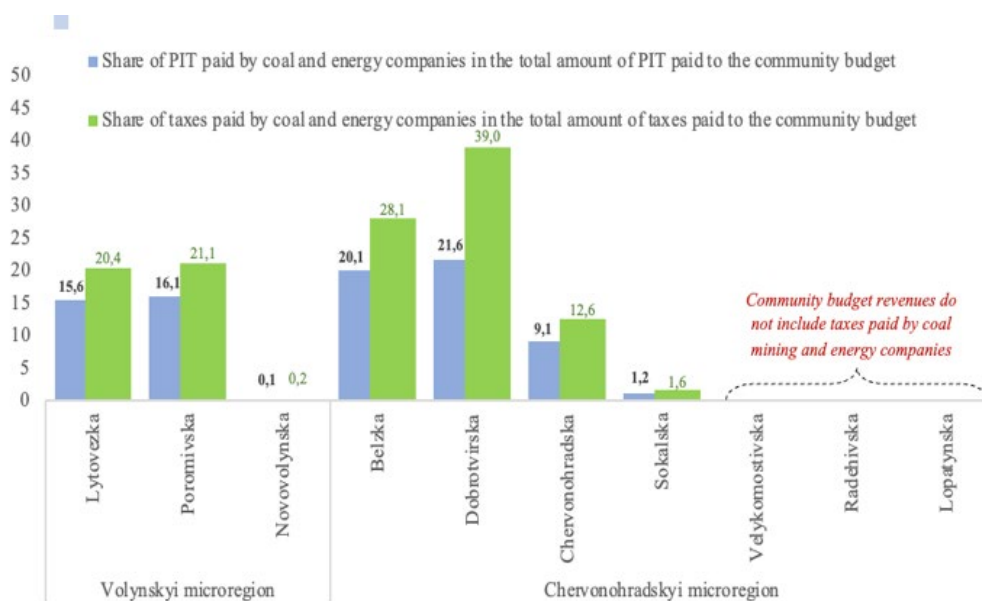
Source: compiled by the author based on [17].

Although the limited impact of coal state-owned enterprises on the development of related economic sectors in the Ukrainian-Polish borderland is a negative aspect (a deterrent to economic development), it may be seen as a certain «airbag» in the context of the need for economic transformation and closure of coal mines due to the economy’s lower dependence on the coal industry.

Nevertheless, when comparing the economic development of Chervonohradskyi and Volynskiy microregions and the role of coal mining in this process, certain differences should be noted.

The economy of Chervonohradskyi microregion largely depends on the development of the mining industry and the results of the functioning of budget-forming enterprises in this industry on their territory. Out of the seven territorial communities formed here, the level of dependence in two (Belzka, where the Stepova mine is located, and Dobrotvirska, where the Dobrotvirska TPP is

the budget-forming enterprise) is critically high and is accompanied by significant risks to their financial capacity (Figure 6). Chervonohradka, which is the center of coal mining in the microregion (five of the six operating mines and offices of coal companies are located here), and Sokalska have a lower level of dependence as they are more economically developed communities with centers in cities that were developing as a city of oblast significance (Chervonohrad) and a district center (Sokal) before the 2014-2020 reform. However, as in the Velykomostivska community, local labor markets here are focused on coal mining. The communities formed on the basis of the settlements of the former Radehivskiy district – Radehivska municipal and Lopatynska settlement territorial communities – have an agricultural economy. But it is also home to a large share of workers employed in the mines or the enterprises that service them.

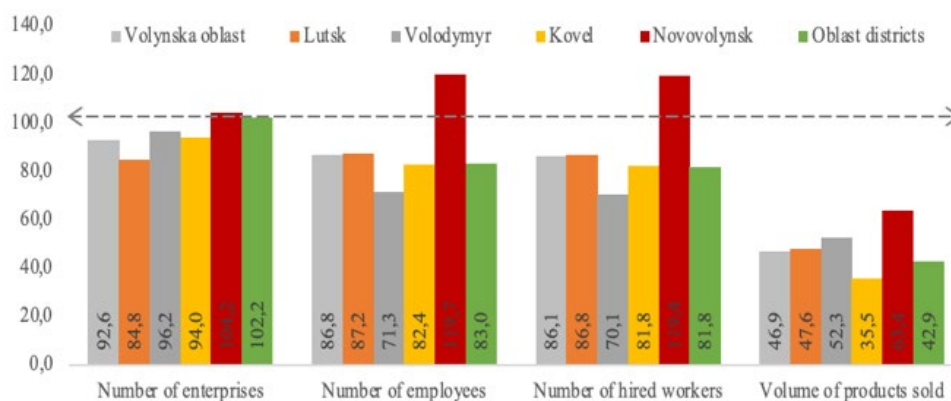


**Fig. 6. The share of taxes paid by coal and energy enterprises in the total tax revenues of community budgets of coal microregions in the Ukrainian-Polish border, 2023, %**

Source: compiled by the author based on [18].

Unlike the coal microregion in Lvivska oblast, Volynskiy microregion is much smaller in terms of territory. More than 80% of the mine fields and a key section of the Novovolynskiy geological and industrial area are concentrated in three communities of the microregion. Meanwhile, the microregion is characterized by a high imbalance in economic development. The city of Novovolynsk, one of the largest cities in Volynska oblast, is its socio-economic center. In recent years, the city has

been outperforming all administrative units in the region in terms of economic growth dynamics (Figure 7), including Lutsk. In contrast to other large cities, the number of enterprises and employees has increased only here. The situation deteriorated only in terms of the dynamics of the volume of products sold, as in all other administrative-territorial formations, although the rate of decline in the city was lower than in the region.



**Fig. 7. Economic growth rate of cities and districts of Volynska oblast by selected indicators, 2020/2015, %**

Source: compiled by the author based on [19].

Since the closure of mines in Volynska oblast was much faster than in other regions of Ukraine (less than 20% of the operating mines remained in 2024), the level of dependence of the microregion's economy on coal mining is currently low. First of all, in contrast to Chervonohradskiy coal microregion, Volynskiy microregion is characterized by much lower employment in the mining industry. While 15% of employees in Chervonohradskiy coal microregion are engaged in coal mining, this figure does not exceed 5% in Volynskiy microregion.

Despite being the center of coal mining, Novovolynska community, which collectively covers 92% of the microregion's economic entities and, in fact, «forms» the demand in the local labor market (90% of vacancies are concentrated in Novovolynsk) [17], depends on this sector for only 0.1-0.2% with regard to the amount of taxes paid to the budget by the coal mining enterprise. Moreover, there is a steady trend of a rapid decrease in the amount of taxes paid by economic entities in the coal mining industry (only 1/3 of the amount of 2021 in 2023).

The deterioration of the situation in the mining industry in Novovolynsk is systemic and has been going on since Ukraine's independence. Since 1991, seven mining enterprises that were part of Volynvuhillya have been liquidated.

In 2001, with the adoption of the Law of Ukraine «On the Special Regime of Investment Activity in the Priority Development Territory in Volynska oblast» (No. 2354-III of April 5, 2001; expired in 2022), the city of Novovolynsk and the village of Blahodatne (Zhovtneve) were classified as priority development territories in Volynska oblast, where a special investment regime was introduced to create new jobs. The policy resulted in the attraction of new businesses to the community (in particular, BRV-Ukrayina and Kronospan UA companies). This approach has become an important

condition for creating jobs after the closure of mines; labour migration to EU countries (including coal mines in Poland and the Czech Republic) was another opportunity for former miners and their families to find employment.

At the present stage, Novovolynsk is the center of production, entrepreneurial activity, and development of the tertiary sector in the microregion. The lion's share of the labor market demand in the microregion is generated by employers from Novovolynsk. Due to the advantage of its location near the EU border and the government's favorable policy towards the city over the years, a powerful galaxy of industrial enterprises has been concentrated here, which has significantly reduced dependence on coal mining enterprises. On the other hand, having had the status of a city of regional significance prior to the 2020 administrative and territorial reform, which provided a certain «prioritization» in social and economic development, the city is an important social center in the region (i.e., there is a significant number of public sector jobs available).

The other two communities, Lytovezka and Poromivska rural communities, which are developing in the wake of Novovolynsk, have an agro-industrial specialization and are much «weaker» in terms of economic development, and therefore depend on budget-forming enterprises on their territory:

– Lytovezka community – Novovolynska mine № 9 of Volynvuhillya, which paid about 1/3 of taxes to the local budget (in 2023 – 15.6%) and provided more than 370 jobs;

– Poromivska community – Buzhanska mine located in the village of Bortniv and Buddyrektsiya state enterprise. Together, they provide 16.1% of tax revenues to the community budget. In addition, Poromivska community is the only one in Ukraine where a coal mining enterprise is being built – Novovolynska mine № 10.

The location of operating mines in communities is one of the key conditions for the economic development of each of them. Mines are the main place of employment in these communities. The possibility of their closure is a challenge for each of the communities, which carries the risk of the loss of financial solvency.

Under current conditions, Chervonohradskyi and Volynskyi coal microregions are identified in strategic documents at the national level as areas requiring special attention and implementation of effective tools to support development in the context of just transformation (Energy Security Strategy approved by the Resolution of the Cabinet of Ministers of Ukraine №907-r as of 4 August 2021 [20]; 2050 Energy Strategy of Ukraine approved by the Resolution of the Cabinet of Ministers of Ukraine № 373-r as of 21 April 2023 [21]; 2030 Concept of the State Target Program for the Just Transformation of Ukrainian Coal Regions approved by the Resolution of the Cabinet of Ministers of Ukraine № 1024 as of 22 September 2021 [22], etc.). They also receive particular attention at the regional level:

– Chervonohradskyi coal microregion: according to the Scheme of Planning the Territory of Lvivska oblast developed by the Ukrainian State Research Institute of Urban Planning and Development «Dnipromisto» (the estimated validity of the document is till 2031) [23], the Chervonohrad-Dobrotvir zone is outlined as one of the three centers that have prerequisites for the formation of industrial hubs; within the framework of the updated 2021-2027 Lvivska Oblast Development Strategy [24], the depletion of coal deposits is identified as a weakness of the region in the context of SWOT analysis, while the economic and geographical location on the border is among the strengths. The objectives in the region's goal tree include optimizing its fuel and energy balance, increasing the use of distributed generation, and developing renewable energy;

– Volynskyi coal microregion: The Scheme for Planning the Territory of Volynska oblast [25] developed by the State Enterprise Ukrainian State Research Institute for Urban Design «Dipromisto» named after Yuriy Bilokon for the estimated period of validity until 2031 suggests stimulating the development of three key industrial hubs in Volynska oblast – in Lutsk, Novovolynsk, and Kovel. The industrial hub in Novovolynsk is defined as a diversified industrial region that includes two industrial centers: Novovolynsk, which specializes in fuel and energy minerals, machine building, and chemical and food industries, and Volodymyr, which specializes in food industry and machine building. According to the Scheme, the priority development zone covers the territory of the entire Volynskyi coal microregion. Moreover, most of the microregion's territory is characterized as a territory of predominantly urban development (urbanization zone), where it is recommended to intensify the existing scientific and production capacity and develop agriculture of predominantly suburban type and areas of short-term recreation. The city of Novovolynsk is defined as the territory of priority development of high-tech industries and certain metropolitan activities (finance, science, exhibition activities, etc.), and the area around the city (rural settlements of Novovolynska, Lytovezka, and Poromivska communities) is defined as the territory of priority development of mining and high-tech industries; the northwestern territories of Poromivska and

southwestern territories of Lytovezka communities are classified as the territories of priority development of the ecological network of the oblast.

**Conclusions.** At the present stage, plans for the just transformation of Chervonohradskyi and Volynskyi coal microregions are being developed with the participation of all stakeholders (regional and local authorities, coal mining and energy companies, miners, businesses, active citizens, certain segments of the population (including youth), etc.). The sources of funding for the projects and activities in the action plans will include the state budget, local budgets, international technical assistance funds, and other sources not prohibited by law. The government is currently discussing the establishment of the Just Transformation Fund for Coal Regions as an effective and transparent mechanism for financing transformation projects in coal regions. Meanwhile, there is currently no legislative and regulatory framework for the creation of a financial resource fund that would accumulate funds to finance projects within the framework of the just transformation of coal regions.

Upon Ukraine's accession to the European Union, coal microregions will have access to the European Just Transition Fund, which aims to mitigate the transition to a carbon-neutral economy by financing measures to diversify and modernize the local economy and reduce the negative impact on employment by supporting retraining. The Just Transition Fund finances projects in regions that are heavily dependent on fossil fuels and carbon-intensive sectors of the economy, including microregions of the Ukrainian-Polish border.

The main directions of maintaining and stimulating the level of economic development of microregions in the Ukrainian-Polish border in the context of the closure of coal enterprises include:

1) preservation and development of the demographic capacity of the territories, which has a significant impact on the socio-economic trends of microregions through the development of the local labor market, intensification of interaction with young people, reform of the specialized education system in microregions, re-profiling and support of miners in their employment, involvement of IDPs (including families with children), and their integration into the socio-economic life of communities.

The employment structure in the coal microregions of the Ukrainian-Polish borderland is characterized by a high share of employees in the mining and processing industries, as well as in the public sector. The share of people employed in the service sector is significantly lower, indicating that this sector is underdeveloped in the microregion. Moreover, the labor markets in both microregions are characterized by a «staff shortage» and a large number of vacancies for blue-collar professionals, including jobs at coal mining and energy generating enterprises. The labor markets of Belzka, Dobrotvirska, Lopatynska, Poromivska, and Lytovezka territorial communities are formed essentially around one large employer and the public sector.

The process of transforming the economy of microregions will lead to a situation where in the coming years the demand for labor performing simple, repetitive work will significantly decrease, and professions requiring higher, more specialized skills and characterized by a high degree of creativity will become more in demand. New skills will be required for specialists in Industry 4.0, ICT, medicine, new energy, circular economy, etc. These



industries will replace the traditional specialization of the microregion. Therefore, resources should be directed, on the one hand, to the introduction of these specialties and the creation of a material and technical base of vocational education institutions, which will increase the level of automation, digitalization, and innovation of production processes, and, on the other hand, to support employees in adapting to new labor market requirements [26];

2) development of a competitive economic environment in microregions. The directions of economic development of Chervonohradskyi microregion include:

- preserving the status of Chervonohrad and Sokal as industrial centers of Lvivska oblast and their further development based on economically sound, energy efficient, and environmentally friendly mechanisms in the process of the country's «green» transition and reform of the coal industry;
  - strengthening economic activity and redirecting the activities of economic entities involved in coal mining, which will help maintain the financial stability of territorial communities. This includes the development of logistics capacities given the region's border location and the burden on Lviv as a logistics center; creation of an energy hub based in Dobrotvir with a focus on decentralized renewable energy sources, which will help attract energy-intensive enterprises to the region; development of light and processing industries, including furniture production and metalworking, which are already actively represented in the region; development of recreational and tourist potential, especially with a focus on the opportunities of the Western Bug, the closed mines, as well as the cultural heritage of the region;
- in Volynskyi coal microregion:
- reducing imbalances in the economic development of Volynskyi coal microregion by attracting investments and diversifying economic activities of Lytovezka and Poromivska communities, which largely depend on the mining industry and the performance of coal enterprises. In particular, the development of the agricultural sector, the expansion of the industrial hub in Novovolynsk, and support for microenterprises;
  - supporting the entrepreneurial activity of the microregion's residents and expanding the range of their economic activities as most individual entrepreneurs operate in trade (providing 79% of taxes paid by entrepreneurs to local budgets), processing industry (12%), and transport (7%);
  - solving the problem of the long-term construction of Novovolynska mine No. 10 of Volynvuhillya, which at the beginning of its construction had great prospects for development, and at the present stage is characterized by outdated equipment and the need for its modernization;
  - promoting the development of renewable energy, which is at an early stage in Volynska oblast, by utilizing the experience of neighboring communities in growing energy crops;
  - developing a network of industrial parks, promoting them as priority development territories with favorable economic and geographical location in the Ukrainian-Polish border.

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