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TRANSFORMATIONAL RESTRUCTURING OF COAL REGIONS IN SLOVENIA

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Abstract: The coal regions of the Savinjsko-šaleška region (SAŠA) and Zasavje in Slovenia are undergoing a gradual phase-out of coal mining, requiring integrated economic, social, and spatial restructuring. This paper presents a spatial framework for the transformation of coal regions, aligned with the Spatial Development Strategy of Slovenia 2050 and informed by the EU Just Transition Mechanism experiences. The proposed approach prioritizes the remediation and reuse of degraded mining and industrial areas for new economic activities, reducing pressure on greenfield land and supporting environmental recovery. Regional development is based on endogenous potentials, including expertise in energy and engineering, renewable energy deployment, circular economy principles, and the adaptive reuse of industrial heritage. Emphasis is placed on ensuring a high-quality living environment, preserving landscape and cultural identity, and maintaining balanced relationships between built and green areas. The restructuring process integrates spatial, economic, and social planning through a dedicated EU Just Transition Mechanism that combines investment support, workforce reskilling, land remediation, and infrastructure development. Inclusive governance and early stakeholder engagement are identified as key factors for social acceptance and long-term effectiveness, while further measures are needed to strengthen climate resilience and sustainable mobility.

Key words: transformational restructuring, coal regions, spatial planning, Slovenia

TRANSFORMACIONO RESTRUKTURIRANJE UGLJENIH BASENA U SLOVENIJI

Apstrakt: Ugljeni baseni Savinjsko-šaleški region (SAŠA) i Zasavje u Sloveniji prolaze kroz postepeno gašenje rudarstva uglja, što zahteva integrisano ekonomsko, društveno i prostorno restrukturiranje. Rad predstavlja prostorni okvir za transformaciju ugljenih basena, usklađen sa Prostornom razvojnom strategijom Slovenije 2050 i zasnovan na iskustvima Mehanizma za pravičnu tranziciju EU. Predloženi pristup daje prioritet sanaciji i ponovnoj upotrebi degradiranih rudarskih i industrijskih basena za nove ekonomske aktivnosti, čime se smanjuje pritisak na neizgrađena (greenfield) zemljišta i podstiče obnova životne sredine. Regionalni razvoj zasniva se na endogenim potencijalima, uključujući znanja iz oblasti energetike i inženjerstva, primenu obnovljivih izvora energije, principe cirkularne ekonomije i adaptivnu prenamenu industrijskog nasleđa. Poseban naglasak stavlja se na obezbeđivanje visokog kvaliteta životnog okruženja, očuvanje pejzažnog i kulturnog identiteta, kao i uravnotežen odnos između izgrađenih i zelenih površina. Proces restrukturiranja integriše prostorno, ekonomsko i društveno planiranje kroz Mehanizam za pravičnu tranziciju EU, koji

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objedinjuje podršku investicijama, prekvalifikaciju radne snage, sanaciju zemljišta i razvoj infrastrukture. Inkluzivno upravljanje i rano uključivanje zainteresovanih strana prepoznaju se kao ključni faktori društvene prihvatljivosti i dugoročne efikasnosti, dok su potrebne dodatne mere za jačanje otpornosti na klimatske promene i održive mobilnosti.

Ključne reči: transformaciono restrukturiranje, ugljeni baseni, prostorno planiranje, Slovenija

INTRODUCTION

The Savinjsko-šaleška region (SAŠA) and Zasavje (Figure 1) in Slovenia are undergoing a gradual coal phase-out and a comprehensive socio-economic and spatial transformation. Ensuring a successful transition requires both territories to establish a new development trajectory that is sustainable, socially equitable, and spatially integrated. This chapter outlines the spatial conception of restructuring within the coal regions, grounded in the guidelines for special areas and thematic domains defined in the Spatial Development Strategy of Slovenia 2050 (MNVP, 2023), and informed by the EU Just Transition Mechanism experiences. The spatial framework delineates the key orientations and instruments for spatial planning and territorial governance in these areas.

In the article, in addition to outlining several key challenges, we place particular emphasis on presenting the measures required to improve current conditions and to achieve a transformative development breakthrough.

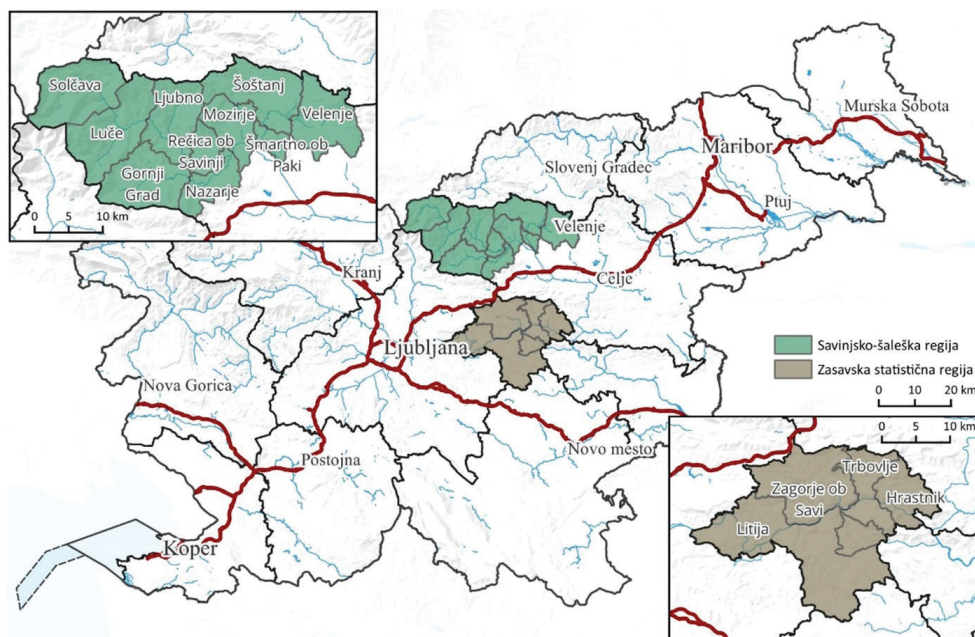


Figure 1: The areas of the Savinjsko-šaleška region (SAŠA) and Zasavje, which are undergoing a gradual coal phase-out and a profound socio-economic and spatial transformation (UIRS, 2025)

CHALLENGES

The development challenges encountered in the process of restructuring coal regions represent a set of complex barriers, needs, and opportunities emerging across the social, economic, spatial, and environmental dimensions of development. A thorough understanding of these challenges is essential for formulating targeted responses, adaptations, and innovations that enable the achievement of sustainable, inclusive, and effective development objectives.

Barriers

- Structural dependence on coal mining: The long-term economic orientation of the regions towards coal-related activities has resulted in a mono-structured economy, hindering diversification.
- Degraded spatial structure: Extensive areas burdened by environmental impacts (spoil heaps, subsidence zones, contaminated soil) require complex remediation interventions.
- Demographic challenges: An ageing population, youth outmigration, and low educational attainment reduce the development potential of the local community.
- Insufficient governance capacity: The absence of coordinated institutional structures for managing the transition slows down the implementation of measures.
- Lack of alignment among sectoral policies: Spatial planning, economic development, environmental policy, and social policy often operate in a fragmented and uncoordinated manner.

Needs

- Establishment of integrated governance: Effective coordination among national, regional, and local actors, as well as across sectoral policies, is essential.
- Remediation and activation of degraded areas: Systematic environmental rehabilitation and spatial preparation for new uses are required.
- Social support and community involvement: The transition must include measures ensuring social security, reskilling, and participatory planning.
- Development of new economic activities: The regions require targeted support for the development of green technologies, tourism, services, and innovative industries.
- Coordinated spatial planning: Spatial solutions must be based on regional specificities and integrated into Regional Spatial Plans (RSPs) and detailed spatial plans.

Opportunities

- Transition to a climate-neutral society: The regions can become pilot areas for the development of renewable energy sources and the circular economy.
- Revitalisation of industrial heritage: Former mining structures and landscapes can be transformed into tourism, cultural or educational assets.
- Strengthening regional identity: Preserving morphological characteristics and cultural heritage enhances the region's distinctiveness.
- Creation of quality jobs: New activities can generate employment and improve overall quality of life.
- Inclusive governance: Early involvement of local stakeholders increases the legitimacy and effectiveness of the transition process.

DEVELOPMENT DIRECTIONS

The development of the coal regions is grounded in the principles of sustainable spatial development, which seek to balance economic, environmental, and social dimensions. Emphasis is placed on harnessing local potentials, including existing knowledge, skills, and regional traditions. The transition encourages the deployment of advanced technologies and circular-economy approaches to support the shift toward a low-carbon society. Development efforts aim to generate new high-quality jobs and to strengthen social cohesion through measures such as reskilling programmes and entrepreneurial accelerators. Crucially, the restructuring process relies on the active involvement of local stakeholders and on interdisciplinary planning, as evidence from practice and research demonstrates that these factors are essential for the successful transformation of coal regions.

MEASURES TO ACHIEVE THE DEVELOPMENT DIRECTIONS

Spatial allocation of activities through land remediation and spatial renewal

New activities and expansions of existing ones are strategically located to promote the remediation and renewal of degraded land, with investments prioritised in abandoned industrial sites such as former mining and thermal-power areas in Velenje, Trbovlje and Hrastnik. This approach simultaneously enables environmental rehabilitation - removal of contamination, stabilisation of subsidence zones and landscape restoration - and the reactivation of underused land without additional take-up of untouched areas. Degraded sites can be repurposed for solar energy facilities or industrial parks, reducing environmental risks and returning the land to productive use. Ensuring high-quality living conditions remains essential: new developments must enhance local well-being through green buffers, noise-mitigation planting, improved access routes and supportive public infrastructure. All spatial interventions must align with the forthcoming Regional Spatial Plan (RPP), which integrates inter-municipal development interests and ensures coherence with regional characteristics. Such activation of degraded areas goes beyond physical renewal by assigning new functions to space; the use of post-mining potentials - transformed landscapes, existing infrastructure and preserved traditions - provides a foundation for new development opportunities. Effective remediation and reactivation thus not only address the legacy of coal mining but prepare the territory to host new economic and social functions.

Just Transition Program and Integrated (Spatial) Planning

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Regeneration and Reuse of Abandoned Areas

When coal-related land uses such as mines, power plants or associated industries are discontinued, it is essential to assign new functions to these areas in line with an integrated restructuring programme. Settlements or settlement parts that have lost their roles due to coal phase-out are repurposed for new activities in coordination with the development of their rural hinterlands. This prevents isolated urban redevelopment and ensures that reactivated sites - such as former shaft complexes transformed into logistics, tourism or energy facilities - are connected to surrounding rural areas through transport links, green infrastructure or local value-chain integration.

The transformation aims to rebalance built and green areas by converting parts of environmentally burdened mining towns into parks, green corridors and recreational spaces, while strengthening connections to the wider landscape. New uses begin with environmental remediation - soil decontamination, stabilisation of subsidence zones and rehabilitation of existing structures - prioritising the adaptive reuse of industrial heritage where viable. Former administrative buildings can serve as incubators or training centres, and large halls can be repurposed into museums, sports facilities or research spaces. Only when reuse is unfeasible are structures removed and replaced. Protecting key elements of mining and industrial heritage - such as shafts, chimneys or workers' settlements - helps retain regional identity while integrating new functions.

International practice shows that such transformations require long-term, coordinated implementation: the redevelopment of the Katowice coal complex in Poland took three decades to convert 57% of the area into a new "Cultural Zone," illustrating the need for a clear, shared vision (Wyrzykowska, 2024). Major restructuring projects in Slovenia - such as the redevelopment of Velenje Coal Mine or the Thermal Power Plant Trbovlje site in Trbovlje - must therefore be supported by detailed spatial plans aligned with the Regional Spatial Plan (RPP), with systematic monitoring to avoid stagnation. Temporary uses (e.g., community gardens, sports grounds, event spaces), facilitated through spatial-verification instruments, help keep degraded areas active until final redevelopment is feasible. Evidence from Huaibei, China, further confirms that successful integration of former mining areas depends on commercial and service density, transport accessibility and the remediation of problematic mining legacies such as subsidence lakes (Hou et al., 2025). This demonstrates that economic activation, infrastructural connectivity and environmental remediation must proceed in parallel for new land uses to become fully embedded in the urban and regional fabric.

Architectural Quality and Place Identity

The restructuring of coal regions should not only introduce new economic activities, but also establish a renewed architectural and spatial identity that enhances regional attractiveness. The redevelopment of degraded land must create a contemporary architectural expression that complements existing spatial qualities. New buildings and spatial interventions should deliver high-quality, innovative architecture while respecting local character, cultural heritage, and natural features, ideally supported through architectural competitions. Preserving and building upon key morphological features - such as linear valley settlements, Velenje's lake-oriented urban form, or the terraced village structures of Zasavje - ensures spatial continuity and reinforces a sense of place. Carefully designed new landmarks can symbolise the post-coal era, similar to how former industrial sites in the Ruhr region have become iconic cultural institutions. Thoughtful architectural integration strengthens both the aesthetic quality of space and the confidence of local communities by linking the industrial past with future development. Respecting the principle of synergy between old and new also supports public acceptance of change, as redevelopment that meaningfully incorporates heritage and local elements is more readily embraced than designs perceived as foreign to their setting.

Stakeholder Participation and Interest Coordination

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FINAL CONCLUSIONS

The coal regions of SAŠA and Zasavje are undergoing a gradual phase-out of coal mining, which requires comprehensive economic and spatial restructuring based on the principles of sustainable development, spatial coherence, and just transition. The spatial framework, developed in accordance with the guidelines of the Spatial Development Strategy of Slovenia 2050 (SPRS 2050) (MNVP, 2023), is founded on the utilisation of endogenous potentials, the deployment of renewable energy sources, and the development of tourism based on industrial heritage (Marot et al., 2012).

Key strategic directions include the rehabilitation of degraded areas, improvement of the quality of the living environment, and the integration of planned interventions into regional spatial plans, thereby ensuring the preservation of landscape characteristics and the functional connectivity of settlements. An effective transition presupposes the simultaneous implementation of economic, spatial, and social measures. Analyses of European experiences indicate that one-sided policy approaches generate predominantly negative effects, particularly due to the underestimation of demographic and social dimensions (Pereto et al., 2025). In this context, central tasks include balancing built and green areas, safeguarding industrial and cultural heritage, and shaping a new architectural identity while maintaining developmental continuity (MNVP, 2023). The success of the transition is directly dependent on early stakeholder involvement and inclusive governance, as their absence often results in delays and resistance to transformational processes (Matern et al., 2024; 2025).

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