Konin region, Poland

Web INTEractive management tool for coal Regions in transition

WINTER

This project has received funding from the Research Fund for Coal and Steel (RFCS) under GRANT AGREEMENT No.101057228

Konin region

Konin Brown Coal Basin is located in the eastern part of Wielkopolska region, mainly in Konin and Turek

districts, on Gnieźnieńskie and Kujawskie lakes and Rychwalska and Turecka uplands (main centres: Konin, Turek, Poland). In particular, Konin Brown Coal Mine is located in Kleczew, which is an urban-rural municipality in the Konin County.

Konin region.

The Konin region of Poland has a population of 130,053 people living in an area of 1,578 km2 at a population density of 82 people per km². 30,949 people are employed, 4550 of them in the coal mining industry. The unemployment rate is at 8.3%. The Konin region produces 7.38 million tons of coal annually . Its total installed capacity for energy production from renewable resources is unreported. The installed capacity for energy production from biomass is 100 MW, from 1 operating plant and no other sources of renewable energy are known. It is unknown what share of power consumption is made up from renewable energy sources.

Konin Brown Coal Mine is owned by a large energy generation group, ZE PAK Capital Group, producing energy in three brown coal -fired power plants. Konin Brown Coal Mine (PAK KWB Konin) currently operates three open cast mines. Two out of those three plants are going to stop coal excavation in 2021-2022, therefore their activities in the nearest future will be focused mostly on post-mining land reclamation. The third mine will operate until 2030. Coal mining caused significant changes in the environment. These large-scale land and water environment transformations are followed by transformations in other components of the natural environment and agricultural land. This translates into losses in the economy, including tourism and agriculture in the region.
Moreover, the mining activities have required water drainage with use of drainage wells and drainage systems. Due to

intense groundwater pumping from the pits, a depression cone has developed, which affects many elements of the natural environment such as soil moisture, water abundance in natural habitats (meadows, forests), water level in watercourses and water reservoirs, groundwater resources etc.

The Konin Brown Coal Basin industrial activities and their transition into green and sustainable economy are covered by the Territorial Just Transition Plan of Eastern Wielkopolska which is presently in the final phase of development.

Legal Framework

Rehabilitation Legislation

In Poland, the legal framework includes regulations and guidelines requiring mining companies to undertake proper reclamation measures and minimise negative environmental impact. The reclamation process is primarily governed by two significant legal acts: the Geological and Mining Law and the Agricultural and Forest Land Protection Law.

Final pit lake of Niesłusz pit.

Reclamation efforts must commence within five years following the cessation of industrial activity. The reclamation process is mostly supervised by the staroste, a local administrative authority responsible for issuing decisions on reclamation and development.

In the context of post-mining area reclamation, conducting an environmental impact assessment may be particularly significant in specific cases. Local spatial development plans

serve a crucial function in delineating the intended land use and establishing conditions for development.

Renewable Energy Sources

Poland's legal framework for renewable energy sources is primarily composed of the Energy Law and the Renewable Energy Sources Act, supplemented by regulations found in the Spatial Planning and Development Act, the Wind Farm Investment Act, and the Construction Law. These acts collectively govern the development, integration, promotion, and location of RES installations in Poland, outlining specific support mechanisms and licensing requirements for projects. While exploring the potential for reclaiming post-mining areas using renewable energy sources, it is essential to consider the environmental impact assessment.

Wind turbines installed on former waste dump.

The flow diagram above represents the Rehabilitation Legislation process in Poland. It outlines the critical legal acts and steps involved in the reclamation of mining areas and the implementation of **Renewable Energy Sources (RES)**. Starting from the foundational laws, it shows the progression

through reclamation measures, supervision by local authorities, the importance of environmental impact assessments, and the specific laws governing RES installations. This visual helps to understand the structured approach Poland takes in managing environmental impacts of mining and integrating RES in post-mining scenarios.

Flow diagram: Rehabilitation Legislation in Poland.

Mine Rehabilitation and Reclamation Showcase

One of the main objectives of WINTER is the identification of best practices regarding various environmental and social aspects of coal transition, such as rehabilitation, reclamation and repurposing strategies of former coal mining areas. The consortium collected information from various examples from all the study areas of the project, namely Western Macedonia, Konin region and Ruhr area as well as other former mining areas, regarding past, current and planned rehabilitation and reclamation work and its environmental, social and economic benefits for each area. Different categories of post-mining land uses were also identified. Below are presented the most prominent examples of post-mining land uses of former coal mines in Greece, Poland and Germany.

Explore the reclaimed sites of Konin region and of other reclaimed areas around Poland.

Góra Kamieńsk

Outer waste dump from Bełchatów mine's overburden which was heaped for nearly 20 years. Rehabilitation carried out on this site allowed to create a unique tourist attraction and locally record high hill available for public use. The reclamation works including : 1.4 billion m^3 of overburden was heaped, dump shaping, supporting infrastructure, surface dewatering, soil conservation and tree planting.

Reclamation works

Outer waste dump from Bełchatów mine's overburden which was heaped for nearly 20 years. Rehabilitation carried out on this site allowed to create a unique tourist attraction ***(click to zoom in)***, locally record high hill available for public use and Renewable Energy generation ***(click to zoom in).***

Wind turbines installed on former waste dump (source: link)

Innovative practices

Artificially snowed and illuminated ski slope, a four-person chairlift with a length of 760 m and two platter lifts with lengths of 700 and 160 m. During summer used as bike and downhill area. All this in close vicinity of a wind turbines.

Location of the artificial skiing slope.

Kazimierz open pit

During the course of mining, projects were developed for the

reclamation and development of the "Kazimierz Południe" open pit area. The projects included various reclamation directions such as agricultural, forestall, aquatic - on an area of 110 ha with a final reservoir on area of 65 ha, communal waste landfill - on an area of 65 ha, construction of Konin Aero Club airport, construction of allotment gardens, a sports stadium and a sports shooting range.

Reclamation of post-mining area

The final reservoir ***(click to zoom in)*** of the Kazimierz Południe open pit was constructed on the basis of the technical design made by Poltegor-Projekt Sp. z o.o. As a result, the area's shallow ponds and marshes will be restored to their pre-mining state. Additionally, there are around 35 ha of agriculturally reclaimed land and 40 ha of forest area in the local vicinity of the reservoir. The airport, constructed on reclaimed land, serves primarily as a training facility for

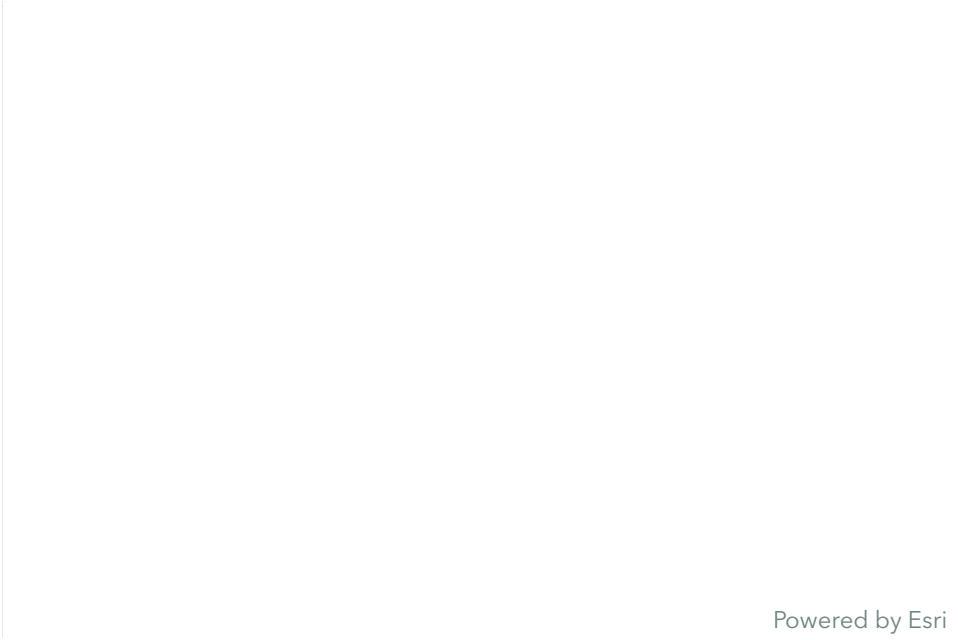
experienced pilotsCurrently, the Konin Aero Club airfield ***(click to zoom in)*** needs to be modernized to enable landing and take-off of larger aircrafts.

Lubstów open pit

The development of the Lubstów open pit was completed in 1982. During its operation, mining activities caused a significant landscape transformation. The decision of the Head of the City and Municipality of Sompolno dated 1980 established the following directions for reclamation and land use in the post-mining areas of the Lubstów open pit: forest, agricultural & aquatic direction.

Lubstów pit lake

The water reservoir is built into the south and east sides of the inner dump. The reservoir and in its immediate vicinity are to be used for recreation, retention, fishing, water sports, etc. Hydroseeding consists of covering the soil surface with a product that consists of seeds from various species of grasses, mulch, cellulose fibres of fertilizers, synthetic polymers and hydrogel, mixed with water.
This preparation, during sowing, takes the form of a gel, which adheres to the ground - even very steep - and provides a substrate for the forming grass. The method is especially recommended for anti-erosion sodding of slopes of water bodies.

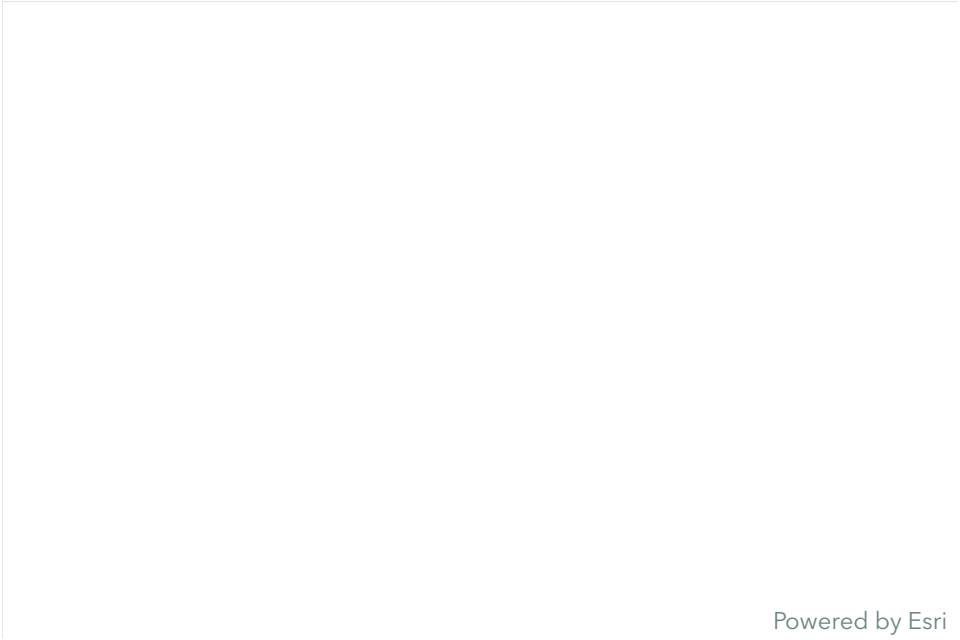


Location of the pit lake on the Lubstów pit.

Guido mine

The Guido mine is a historic deep coal mine and museum in

Zabrze. It is a well-recognized landmark in mining focused region of Silesia.
The port-mining land use is related with experimental mining and testing of mining equipment, Museum of Hard coal mining, cultural recreational and leisure activities. Thus, the reclamation activities are focusing in the preparation of underground tunnels and chamber for touristic visits.



Location of the Guido mine museum.

Innovative practices

Deep hard coal mine transformed into underground tourist site with surrounding museum buildings and allowing the attraction of simulated mining work.

Location of the Guido mine museum.

Spatiotemporal evolution

Konin region

According to the quantification of the CLC products in Konin region, an analysis of the spatiotemporal evolution was carried out during the time period 1990 to 2018. Notably, there was a decrease of agricultural areas up to 6.35%, while the urban sub-categories (Industrial, commercial and transport units Mine, dump and construction sites, Urban fabric) and forest and seminatural areas increased by 73.26 % and 14.95%, respectively. Specifically, regarding the three urban sub-categories, the highest increase identified in urban fabric class accounted for up to 96.69%. This was followed by industrial, commercial, and transport units, which increased by 87%, and mine, dump, and construction sites, with a more moderate increase of 28.5%. Additionally, the wetlands decreased by 29.65%, while the water bodies increased up to 33.27%, during the observed period.

Relative percentage coverage increase or decrease of LC/LU types in Konin region, during the time during the 1990 to 2018.

Regarding the monitoring of spatiotemporal changes, the expansion of urbanization was observed in settlements near the Kazimierz, Jozwin, and Adamow mines. It's noteworthy that reclamation processes depicted in mining pits that existed in 1990, which have transformed into agricultural and semi-natural areas. Additionally, the evolution of the Jozwin open-pit mine is represented during the period from 1990 to 2018. This involved changes in land uses, transitioning from arable lands to mine, dump, and extraction sites. These land use changes were accompanied by the expansion of existing settlements and the development of new ones near the industrial areas of the mining pit.

Spatiotemporal evolution of Konin region based on the Corine Land Cover products (1990-2018).

Jóźwin

Based on the quantification of spatiotemporal results in the Jóźwin mine, it is notable, the ongoing mining activity in the most area of the open-pit from 2018 to 2021. The following diagram depicts the land cover classes, indicating a relatively stable status for the mining activity. Particularly, in terms of relative percentage, the mining activity areas decreased up to 12 %, while the vegetation class increased up to 402 %. Furthermore, the bare soil class maintains relatively stable with a small decrease up to 12 %, whereas water bodies indicating an increase up to 91.31%, during the 2018 to 2021. The ML products also depict reclamation process activities, especially in the southwestern site and an expansion of mining activities in the southeastern part of the mine.

Land Coverage of Jóźwin coal mine during the time period 2018 to 2021.

Powered by Esri

Spatiotemporal evolution of Jóźwin mine open-pit based on Machine Learning products (2018-2021).

Kazimierz

Following the case of the Kazimierz mine, where industrial activities have already reduced, according to the fowling figures it is obvious that reclamation efforts are taken place especially in 2020 and 2021. Specifically, based on the spatiotemporal evolution of LC, a significant portion of the mine boundaries has tranfromed from bare soil to vegetation, reaching a relative increase up to 466.94 %. Furthermore, the mining activity area exhibits a very small percentage of the total coverage in 2018, up to 12.65 %, compared to the other mines, indicating a substantial transformation towards a "green" state. Lastly, the coverage of water bodies is in high percentage values from the beginning of the processing period, with an increase up to 41.26% in 2021.

Land Coverage of Kazimierz coal mine during the time period 2018 to 2021.

Spatiotemporal evolution of Adamów mine open-pit based on Machine Learning products (2018-2021).

Adamów

Regarding the spatiotemporal results at the Adamów mine, it is noteworthy that the reclamation phase is an ongoing process, particularly in the southern and western parts of the studied area. Based on the changes in Land Cover (LC) over time, the coverage of mining activity areas has decreased by 19.90% in relative terms, while the Bare Soil and Vegetation classes have increased by 10.09% and 67.83%, respectively. In terms of 'green transition' classes illustrate a positive trend, representing up to 60% of the total coverage of the Adamów mine. On the other hand, the coverage of water bodies

remained relatively stable, with a slight increase of 7.18% during the period from 2018 to 2021.

Land Coverage of Adamów coal mine during the time period 2018 to 2021.

Spatiotemporal evolution of Adamów mine open-pit based on Machine Learning products (2018-2021).

Renewable Energy Sources scenarios

Powered by Esri

Jozwin

According to the Polish case study, the potential suitable areas for the installation of **Photovoltaic parks (PV)**, which are mainly located in the western and the southern part of the Jóźwin with the total coverage up 2.4 Km^2. In case of **Wind Parks (WP)**, the suitable areas are illustrated with blue color covering similar areas as the PV with additional coverage in the central side of the mine covering up to 2.84 Km^2. Particularly the 19.27% can be used for 'Potentially suitable areas' for WP, which corresponds to 2.84 Km^2 of the mine's total area. Similarly, the 16.28% of the total area can be used for PV.

On the other hand, more than 14 % consist of the overlapped area that can be used for both **Renewable Energy Sources (RES)**, due to the smooth topography of the study area.

Powered by Esri

Kazimierz

The results of the implemented geospatial analysis is showing that for the proposed installation of both RES, the suitable areas are very similar in terms of coverage reaching a total coverage up to 2.25 Km^2 and 2.00 Km^2, respectively. Particularly the 10.83% can be used for 'Potentially suitable areas' for **Wind Parks (WP)**, which corresponds to 2.00 square kilometers of the mine's total area. Similarly, the 12.19% of the total area can be used for **Photovoltaic parks (PV)**.

On the other hand, 10 % consist of the overlapped area that can be used for both **Renewable Energy Sources (RES)**, due to the smooth topography of the study area.

Powered by Esri

Adamow

According the implemented scenarios, the areas that are suitable for the installation of **Photovoltaic parks (PV)** are depicted with yellow color, with the largest coverage concentrated in the central part of the mine. Additionally, suitable areas are also detected along the boundaries in the northern edges of the mine, with a total coverage area up to 2.13 Km ^{2}. Regarding, the suitable areas for the WP installation, they largely overlap with the PV areas, with a slight difference in the southern side of the mine, reaching up to 2.13 Km ^{2} .

Particularly the 17.84% can be used for 'Potentially suitable areas' for **Wind Parks (WP)**, which corresponds to 2.10 Km ^{2} of the mine's total area. Similarly, the 18.10% of the total area can be used for PV.

On the other hand, more than 15 % consist of the overlapped area that can be used for both **Renewable Energy Sources (RES)**, due to the smooth topography of the study area.

Web GIS Platform

You can access the platform through the following **link**!

or scan the QR code in the image below!

This project has received funding from the Research Fund for Coal and Steel under grant agreement No. 101057228.

Contributors

Pavlos Krassakis, PhD (c)
Geologist - GIS specialist

Andreas Karavias, MSc
Geographer - GIS & EO specialist