Ruhr area, Germany

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

Ruhr area

The area of Ruhr in Germany has a population of 5,100,000 people. The population density is 1,150 people per

square kilometer. Approximately 1,800,000 people are employed, with fewer than 1000 working in the coal mining industry. The unemployment rate is at 9.1%. The total GDP was reported in 2020 at 167 million euros.

Ruhr area.

The Ruhr area has ceased coal production, and has a total installed capacity of renewable energy resources of 1,688 MW. Renewable energy resources in use are phtotovoltaics on roofs and in open fields, hydropower, wind, sewage gas, mine gas, landfill gas and biomass. Energy from renewable resources currently makes up 7% of the share of power consumed.

The transformation process already started in the late 50ies of the last millennium with first coal mine closures. Until 1963 already, 33 coal mines were closed with an annual total output of 10 Miot. In 2008, the German government decided to phase out hard coal mining by 2018. The current transition phase is focusing on the shut down and demolishing of the coal fired power plants in the Ruhr area. This decision enabled the coal mining regions in Germany, the Saar and the Ruhr area to prepare the post coal mining time within this period of 10 years. The first step in this transformation process was the development of a strategic perspective for the region for the next decade. Based on the previous urban development policies, the so called “concept Ruhr” took up the future challenges and turned into operation in regional development concepts and master plans. These concepts and plans were also the base for applying and receiving EU regional development funding.

60+ Years in energy Transition

Mid 1950s

>480.000 Employees in coal mining industry
~2,5% Unemployment
234 coal mining facilities
148 mines
1 Universities
Folkwang 1927

Ending 1980s

100.000 Employees in coal mining industry
15,5% Unemployment
28 coal mining facilities 21 mines
12 Universities
THGA 1971

Today

270.000 Students
8,8% Unemployment
2018: Closure of last mine Prosper-Haniel
22 Universities (>270.000 Students)

Green transition of Deusenberg, Dortmund 2016 -2020.

Legal framework

Rehabilitation Legislation

In the German legal system, there is a separation between mining law, which regulates the exploration, extraction, and completion of a resource exploitation project, and post-mining land uses, which are implemented after the release from mining supervision. This is important to assume an end user perspective.

In principle, the operational closure plan from the Federal Mining Act makes use of the laws and guidelines of German environmental law, but the responsible mining company is only obliged to carry out the reclamation to a certain extent. The decisive factors are, on the one hand, hazard prevention and on the other (economic) remediation. This means in consequence that the establishment of any post-mining land use can require additional reclamation work. The scope is based on the land use to be achieved.

Renewable Energy Sources

In Germany, the Renewable Energy Sources (RES) Act, the Federal Energy Act and the Wind Energy Requirement Act are

Wind turbine and power plant.

the main legal instruments the promotion and feed-in of electricity from renewable sources. According to the current legislation the operators of a new RES project have the full responsibility of the licensing of the project and its implementation, but also of all the preparatory works that need to be done in a formerly mining area before the construction, e.g. ensuring the statics of a mining dump before a wind energy plant is erected on it.

Flow diagram: Rehabilitation Legislation in German.

Here is the flow diagram depicting the Rehabilitation Legislation process in Germany. The diagram illustrates the sequential steps, starting from the mining law, which includes exploration, extraction, and completion of resource exploitation, to the responsibilities and legal frameworks involved in post-mining land uses and renewable energy source (RES) projects. Each box represents a key stage in the process, with arrows indicating the flow and connection between each step. This visual representation helps in understanding Germany's approach to managing mining activities and transitioning towards sustainable practices in post-mining scenario

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 Ruhr area.

Lohberg

The Lohberg mine began mining in 1912 and ceased production on December 31, 2005, after almost 100 years. In 1955 more than 5.400 people were employed and the production of hard coal amounted to about 3.2 million tons. During the operating phase, hard coal was mined from a total of five underground levels.

The reclamation process already started during the active mining phase with the successive backfilling of the deep shafts (2000: Shaft Lohberg 3, 2006 Lohberg 1 and 2). After closure the mining facilities above and below ground were deconstructed and/or marketed successively. The reclamation of real estates started simultaneously. The perspective for the reclamation of the whole Lohberg site includes the unification of the original mine site and the already renatured adjacent

dump sites.

Best practices used during reclamation

The main objective of the project consortium is to develop the largest CO2-neutral quarter in Germany and, beyond that, an energy-plus location. The goal of the energy concept is a decentralised, 100% supply from renewable energies, CO2-free and efficient. This includes the energetic refurbishment of existing buildings, new building sin accordance with the Energy Saving Ordinance EnEV 2014 (and 2016) and savings in individual consumption. The electricity and heat supply are to be implemented as a mixture of geothermal energy, solar thermal energy, biomass, photovoltaic, wind power and mine gas or water.

Current status

Almost all the sites in the central and commercial cluster ***(Click here to zoom in)*** have been sold, reserved or are about to be contracted. A 200-meter-high wind turbine on the Lohberg-Nord dump site sends ***(Click here to zoom in)*** out a signal for the Lohberg Energy-Plus site. This turbine produces around 9,000 MWh of electricity per year. This amount is sufficient to supply the households in the Lohberg district as well as the creative quarter Lohberg with electricity.

Ewald

The mining operation at the deep hard coal mine Ewald started in 1877. During its active time, was developed into one of the most productive collieries in the Ruhr area and temporarily employed over 4,000 miners.
After 123 years of underground coal production, operations were discontinued on April 28, 2000.
The perspective for the reclamation of the whole Ewald site includes a commercial and logistics location on the former operational area and a dump site landscape. The new landscape consists of the two former dump sites and the “Ewaldsee”, a lake that has developed in a mining induces subsidence area.

Measurable effects and long-term benefits

In the middle of Europe's largest hard coal dump site landscape, a commercial and logistics site of European stature has been created. It is the largest European industrial complex on hydrogen and fuel cell technology with a numerous leading projects in the field of renewable energies and nanotechnology and spaces for innovative start ups.
The bottom line: over 1,500 jobs on a showcase site with high recreational value.

Ewald site.

Reclamation work

In the beginning, the main reclamation task was to merge two

dump sites into one big, which is now the 750 ha Hoheward Landscape Park ***(Click to zoom in)***. The dump site was developed for the installation of a sundial, the construction of paths, the horizon observatory ***(Click to zoom in)*** and the dragon bridge ***(Click to zoom in)***. Since 1997 neighbouring and already revegetated dump site Hoppenbruch is equipped with a wind turbine ***(Click to zoom in)***, which produces 3 million kWh/a and supplies 800 households with electricity (Brüggemann, 2011).

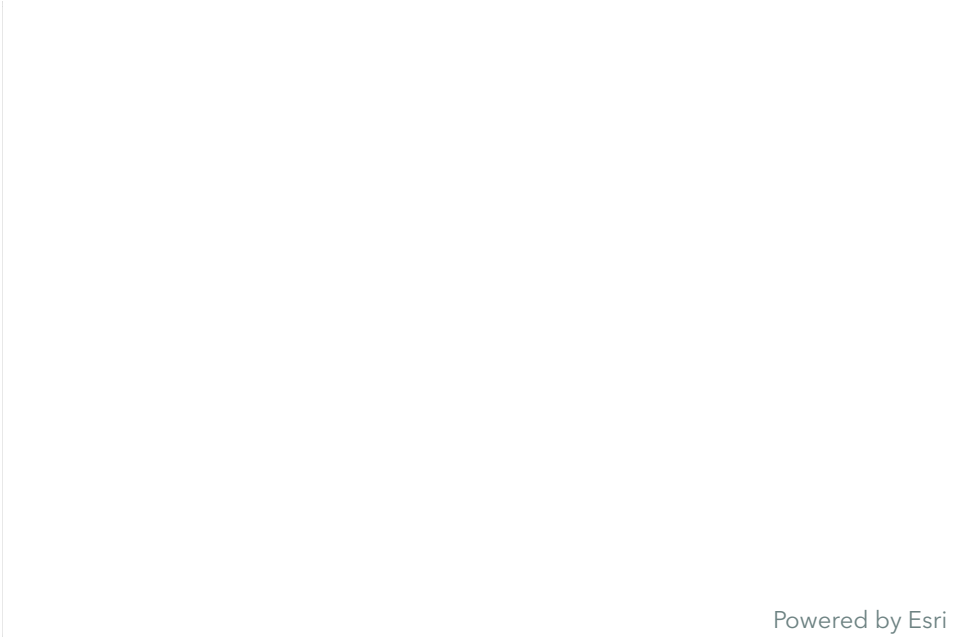
Alpincenter Bottrop

Alpincenter Bottrop is a great example of rehabilitation of former mining areas into recreational use and tourist and sport facility.
The centrepiece of the new facility was to be the world's longest covered ski slope. Catering facilities,conference rooms,

the necessary parking spaces and a ski and equipment rental service complete the offer. At a later stage, a hotel and a discotheque were to be built. Additional commercial sports facilities will be created on the outdoor grounds with a high rope climbing course,a summer toboggan run and a wind tunnel.

Innovative practices

World's longest covered ski slope; Visitors should have the opportunity to ski or snowboard all year round, regardless of the season or weather. Due to the given, strong slope, the building does not have to be supported on stilts as is the case with comparable facilities



Location of the the world's longest covered ski slope.

Mont Cenis

Mont Cenis is a great example of rehabilitation of post mining

land for public use in metropolitan area with a mix of various land uses. Former mine site is used among others as housing, commercial centre, renewable energy production and heritage site.

Innovative practices

A wood-beam supported micro-climate enclosure: 180 m long, 75 m wide and 15 m high, equipped with 10 ha roof integrated photovoltaic solar power plant, a centrally and automatically controlled aeration and deaeration system and a high-performance battery storage system with a capacity of 1.2 MW.

Mine gas-fired combined heat and power plant supplies electricity into the grid of the city.

MARK 51°7

MARK 51°7 is the name of the new innovative quarter that has been created on the site in the third generation.
From 1860 to 1960, the site was a hard coal mine area called Dannenbaum. After the end of mining, a large Opel automotive plant used the site between 1960 and 2014 until the closure of the factory due to lacking economic viability. Only the administrative building of Opel outlasted the demolition process finished in 2015.

Heating and cooling system

The energy supply of the buildings for heating and cooling will be carried out in a resource- saving way by integrating geothermal energy and district heating. Geothermal energy is acquired through mine water. Heat and cold can be obtained holistically via a four-wire system on the entire area following a prosumer solution: Investors are not only customers but also members.

Community involvement

MARK 51°7 site is being developed together with the city of Bochum as part of an integrative concept.
The reclaimed sites are characterized by: Excellent infrastructure near city center; Knowledge spillover; Local and national networks on an international level; Qualified workforce and talent pool; Universities and institutes; Leisure, art, and culture; Flexible area cutting.
Surveys predict more than 3,500 jobs to be generated on the area of MARK 51°7, not considering impulses towards associated local and regional economies. Nevertheless, expected impacts regarding long-term unemployment are considered to be marginal (Funke, 2019).

Location of MARK 51°7.

Ruhr area, Germany

Explore the reclaimed sites of Ruhr area.

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Rheinpreußen

Before : Mining waste heap

After : Landmark with art

Powered by Esri

Angerpark

Before : Steel industry and slag heap

After : Landmark and recreation

Powered by Esri

Gasometer, Oberhausen

Before: Gas holder

After: Industrial monument and exhibition hall

Mining heap Hanie,l Bottrop

Before: Mining waste heap
After: Open air exhibition; Station of the cross; Amphitheater; a.o.

Mining heap "Beckstraße", Bottrop

Before: Mining waste heap

After: Landmark

Mining heap "Scholven", Gelsenkirchen

Before: Mining waste heap.
After: Energy production (wind).

Mine "Zollverein", Gelsenkirchen

Then: Coal mine and coke plant .

Now: UNESCO world heritage site and mining museum; hotel and gastronomy.

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Port "Bismarck", Gelsenkirchen

Then: Coal port for the mine "Graf Bismarck"
Today: Marina, housing and business

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Mechtenberg, Essen/ Gelsenkirchen

Before: Natural elevation and (coal) waste dump
After: Landscape park

Before and after reclamation.

Mining heap Hoheward, Herten

Then: Coal waste heap

Now: Obersvatory; sundial; viewing platforms

Zeche "Recklinghausen", Recklinghausen

Then: 1. Coal mine; 2. Training mine
Now: Show mine / visitors mine

Mine "Hannover", Bochum

Then: Coal mine

Today: Industry museum

Mark 51°7, Bochum

Then: 1. Mine" Dannebaum"; 2. Car production (Opel)
Now: Business-, industry, and technology campus

Mine "Robert Müser", Bochum

Then: Coal mine
Now: Mine dewatering

Deusenberg, Dortmund

Then: Waste dump.
Now: Energy production (solar) and mountain bike trail.

Then and now.

Lake "Phönix", Dortmund

Then: Steel industry.
Now: Artificial lake and upper class housing.

Then and now.

Spatiotemporal evolution

Ruhr area

In the Ruhr area, quantification of the CLC products revealed that the reclamation processes have already started from 1990. In particular, there was an increase in manmade environments as well as in forested and semi-natural areas, in terms of relative changes, by up to 16.77. Specifically, the most significant increases were identified in the urban fabric and in industrial, commercial, and transport units, reaching up to 9.25% and 34%. On the other hand, the areas designated as mines, dumps, and construction sites decreased by 51.46 %, highlighting the reclamation efforts in the Ruhr area. Additionally, water bodies increased by 38.41%, while

wetlands decreased by up to 75.5%. From the perspective of spatiotemporal LU/LC changes, a substantial portion of the mine, dump and construction sites converted to industrial and commercial units as well as to water bodies, forest and seminatural areas. These changes illustrating the advanced reclamation and rehabilitation processes of Ruhr area that have been implemented since the 2018.

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

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

Web GIS Platform

You can access the Web GIS Platform through the following **link**!

or scan the QR code in the image below!

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