

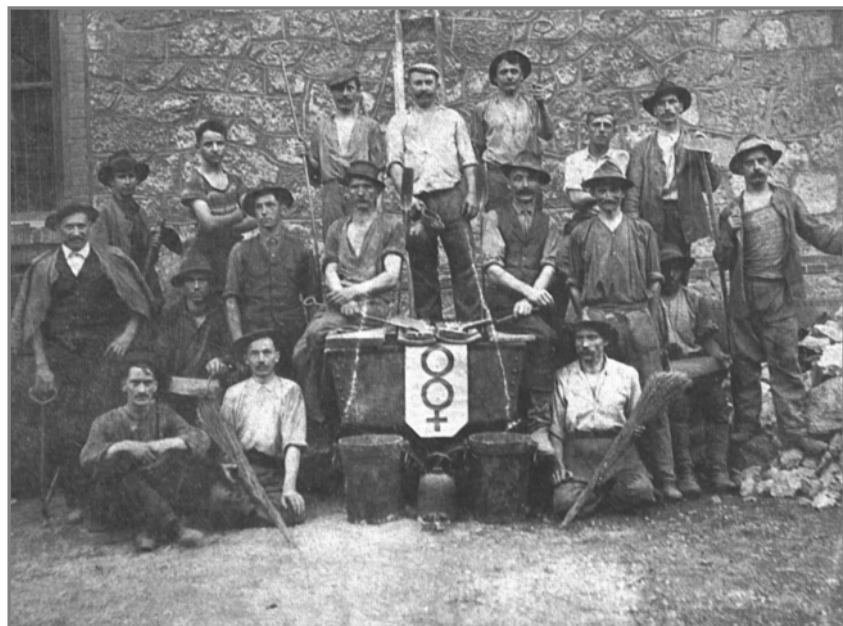
The current state and future of mining in Slovenia

1. Introduction

Slovenia is a small country with an area of 20,256 km² and a population of 2 million. The mining industry in Slovenia has had a very long tradition, dating from prehistoric times. A number of documents describing metal mines in the Kranjska and Goriška region, as well as Istria, which were in operation from the 13th to the 18th century, still remain preserved. The oldest mine, which is now being closed is the mercury mine of Idria. It has been operational without interruption since 1490. The mine of lead and zinc in Mežica is the second oldest and also now in the stage of being shut down. It has operated for over 300 years.

A number of collieries sprang up in the middle of the 18th century and even more began to operate at the end of the 19th century. In fact, 46 collieries were operational in Slovenia during the mid 50s, as well as 5 metal mines and a number of others.

The most recently established mine in Slovenia is the uranium mine in Žirovski vrh. It was built in 1990 and is now likewise, in closure stage.



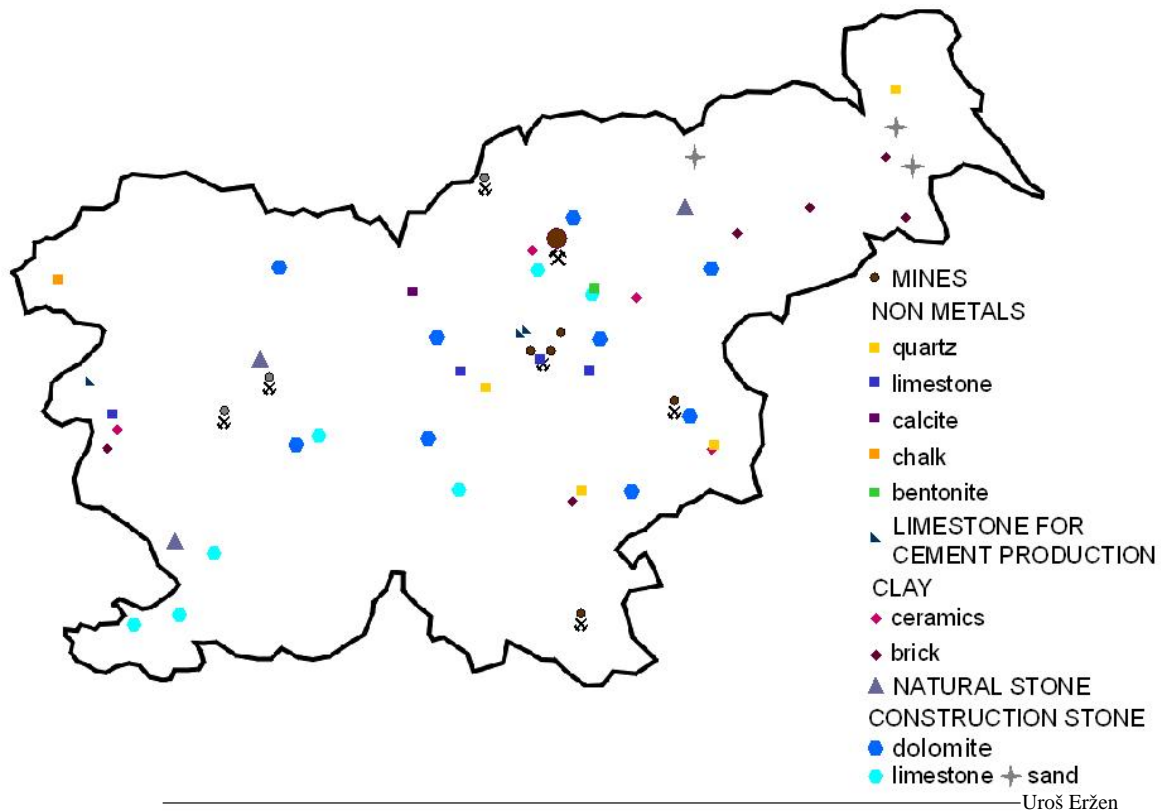
Only one colliery seems set to remain functional during the next 25 years – the lignite mine in Velenje. Its operation is closely related to a nearby thermal power plant and it produces in excess of 4 million tons yearly. The second remaining colliery has a yearly production of approximately 1 million tons, but is set to be shut down in 2007. All other coal and metal mines have already been closed down or are in the stage of being closed.

The mines producing non-metals still have a future, however, and are continuously being developed. The same applies to quarries and deposits of various other materials needed by the construction industry.

2. The current state of mining in Slovenia

2.1. Collieries

Still in operation is the Velenje lignite mine, one of Europe's largest underground lignite mines, as well as being amongst the most advanced mines in Europe, particularly with respect to the equipment used in the mine. Consistent with the country's strategic development of the domestic energy sector and with a planned long-term yearly output of 4 million tons, the mine has an important place in the country's energy supply.



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The company's basic strategic policy is:

- to ensure a sufficient output of lignite in order to supply the thermoelectric power station in the vicinity,
- to organize the excavation of lignite and all other company activities in such a way that its lignite will compete successfully in price with imported coals,
- to provide the highest possible levels of health and safety for its employees,
- to find effective solutions whenever ecological problems emerge as the consequence of energy-producing activities (mine and thermal-powered plant).

The position and shape of the seam have already been determined. The seam extends under the valley at depths between 200m and 500m, its length being 8,3km and its maximum width up to 2,5km. The average thickness is about 60m, while the maximum thickness is 160m. The average calorific value of lignite is approximately 9Mj/t.

Available quantities of coal reserves are estimated to be approximately 320 million tons. 160 million tons have already been excavated.

The knowledge of the hydro-geological parameters is of extreme significance in mining since they serve as a basis for preventive measures taken against in-rush of water. The amount of water (approximately 4 million m³), which needs to be pumped out annually in order to ensure normal coal production, dictates prompt and computerized data processing and interpretation.

The Velenje long-wall method

The basic concept behind this approach to excavating coal by using the long-wall method is that the area of exploitation extends above the supported roof-coal of the face, thus aiding the natural forces which break and crush the coal-seams, an/or assisting the natural process by introducing an artificial method, e.g. blasting.

Parameters of exploitation:

- Height: 10m – 20m
- Length: 90m – 130m
- Production: 3000 – 10,000 t/day
- No. of miners per face: 55 – 65 man-shifts/day
- Mining efficiency: 50 – 150 t/man-shift
- Productivity: 30 – 90 tonnes per meter per day

The Velenje mine has been actively involved in the process of eliminating the negative effects of mining; particularly noticeable were sinkage and slippage of the land surface and the rise of water pollution.

2.2. Non-metal mines and quarries

Slovenia enjoys a rich tradition of harvesting non-metal mineral deposits and other materials



required by the construction industry, both in quarries and surface mines. Over a 100 companies and individuals own mining rights for non-metals and stone, resulting in over 200 surface mines and quarries. Of those, 50% can be classified as very small quarries and mines (yearly output of under 70,000m³), 40% as middle-sized (70,000m³ – 300,000m³) and only the remaining 10% can be classified as large mines and quarries (over 300,000m³).

The total amount of produced non-metallic mineral materials and stone is increasing yearly. In 2000 this value was 19,759,000t, which is 9,9t/inhabitant per year, a number comparable to those in countries of the EU.

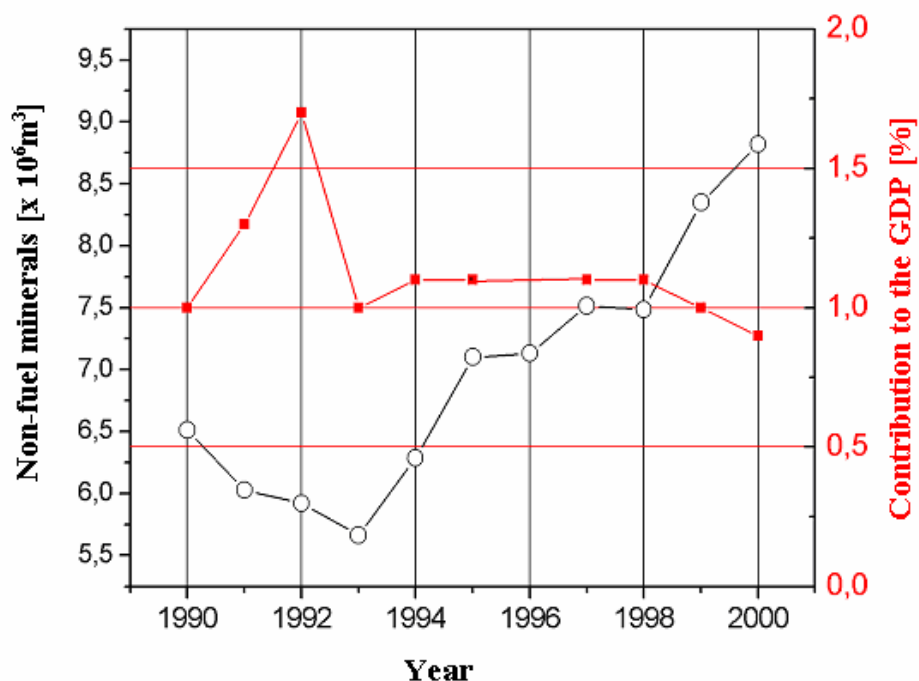


Figure 1: The production of non-metal mines and quarries in the last decade

	Slovenia Year 2000	Slovenia Year 2000
	[m^3]	[t]
Betonite		400
Calcite		176 000
Kaoline		
Chalk		900
Quartz and Quartz sand		238 000
Talcum		
Tuff		78 000
Ceramic clay		90 000
Brick clay	330 000	580 000
Natural stone	36 000	98 000
Marl, limestone for cement production		1 471 000
Construction stone, -keratophyre and diabase, -limestone, dolomite	4 022 000	13 916 000
Sand	1 390 000	2 770 000
Other		
Total		19 759 000

Table 1: The production of non-metal mines and quarries in the last decade

3. Slovenian experience in the environmentally-friendly closure of mines

A large number of smaller collieries and metal mines have been abandoned in the last 30 years. A considerable percentage of those closures occurred when the need for environmental protection had not yet become apparent. The employees of such a mine were normally easily able to move and get a job at another mine.

Due to stricter requirements with regards to environmental safety and due to the transition to market economy, it became necessary to stop excavating coal and minerals in larger mines as well. A total and permanent cessation of mining activities required extensive closure and rehabilitation works in order to implement environmentally friendly closures.

The following mines in Slovenia are currently in the stage of being closed:

- the mercury mine in Idria
- the lead and zinc mine in Mežica
- the uranium mine in Žirovski vrh
- the colliery of sub-bituminous coal in Zagorje
- the colliery of sub-bituminous coal in Senovo
- the colliery of sub-bituminous coal in Kanizarica
- the colliery of sub-bituminous coal in Trbovlje-Hrastnik

Before the decision to close down is taken, an economical-feasibility analysis is performed to determine the possibilities for a continued operation of the mine. Such an analysis must encompass all aspects of mine production: geological (ore reserve), technical, environmental, economical and social aspects.

On the basis of such an analysis it is then possible to take the decision to shut down the mine either

- for a specific period of time, or
- totally and permanently.

When a permanent closure is required, the process of elaborating on the closure programmes begins. Individual programmes have to specify:

1. business activities of the mine up to the point of closure
2. all activities and works necessary to proceed with the closure of the mine
3. all activities and works for the rehabilitation of the negative environmental impact of the mine
4. battling social difficulties and problems of the employees and their families resulting from the closure
5. a time-plan of all activities concerning the closure
6. the necessary means and resources required to implement the above activities

The main and basic goal of mine closure, in the technical sense of the work, is to abolish all consequences (as is possible) of the mining, decreasing the harm done to the environment and protecting the nearby population from any possible hazard. Naturally, settlement planning and the appropriate legislation also have to be considered.

Once the proposed programmes have been scientifically revised and accepted, the chosen financial construction also needs to be analysed and approved.

The closure of mines is therefore a technically demanding and expensive undertaking. As a rule, companies exploiting a certain deposit should solve and rectify harmful environmental impact of the mining when the mine is still in operation, or else the owners should secure the financial means required for closure and rehabilitation activities necessary when the mine is actually shut down.

The mines, which have been, or are being, shut down in Slovenia, have operated for over one hundred years. Having changed ownership a number of times, they finally became property of the state. Once the decision to close down was taken, a law is passed by the government, which ensures an environmentally friendly closure and the required funding.

4. Education and research activities in the field of mining

Several vocational qualification programmes are currently being offered at the Velenje Centre of secondary schools:

- for the title of Qualified Miner (a course lasting three years, once the students have completed their compulsory 8-year formal education)
- for the title of Mining Technician (lasting four years, once the students have completed their compulsory 8-year formal education)
- for the title of Engineer (lasting two years, having completed the four-year technician course)

At the higher level, the Faculty of Natural Sciences of the University of Ljubljana offers the following:

- a Diploma course (lasting three years, students having completed their formal secondary education)
- an undergraduate university course (four years, having completed a formal secondary education)
- postgraduate courses
 - o a Master's degree (two years, having completed the undergraduate course)
 - o a PhD (on year if taken after the Master's course, or three years if taken directly after the undergraduate course)

The number of students at the Centre of secondary schools has been on the decrease for a number of years now. Likewise, the number of students at the Dept. of geotechnology and mining (University of Ljubljana) seems to have stagnated.

If we draw some conclusions in attempt to predict the future of mining-related courses in Slovenia:

- Mining is, and will, in long-term, play an important part in the industry. Every country requires mining experts capable of using environmentally friendly methods of processing ore, whether locally or abroad. Therefore mining remains an important university course.
- Specialist knowledge, acquired by mining experts, is very much sought after in relation to environmentally friendly technologies. In particular, this applies to all types of underground construction, from tunnels to underground waste disposal, separating



industrial waste from secondary materials, deep drilling for research in geo-technical construction, geophysical research, explosives etc. Students taking part in our geotechnology course acquire this expertise – without it, we cannot guarantee environmental friendliness in Slovenia. The course in geotechnology (begun in 1992) is therefore to be continued.

Both the mining and geotechnology courses will continue to be developed and improved.

Mining course

Educates engineers of a broad profile. They are familiar with the techniques of exploring and opening possible mining sites, the technology of surface and underground mining and processing/refining both mineral and fuel-providing raw materials.

Geotechnology course

Educates engineers of a broad profile, fully qualified in the construction of all kinds of underground spaces and geotechnical constructions, waste management, blasting techniques and geophysical measurements.

Research and development

The majority of the research and development work in the field of mining is currently being conducted at the Faculty of natural sciences of the University of Ljubljana, Institute of mining, geotechnology and environment (IRGO) and the Velenje colliery.

During the past few years, the R&D work suffered extensively due to utilising all the available research experts in the field of mine closure.

The production of coal at the Velenje mine continues, but it will become necessary to find alternative uses of the domestically produced coal and increase the operational period of the Velenje mine. There also exist numerous possibilities of additional research into underground construction methods and environmental friendliness.

There is certainly no progress without well organised research work. It is necessary to utilise the potential in mining research, beginnings with the integration of individual research institutions (University of Ljubljana, Institute for mining, geotechnology and environment and the Velenje Lignite Mine) into European research programmes.

The experience gained by Slovenia in the area of thick seam coal mining and mine closure could prove to be important to all the other EU countries.

5. The future of mining in Slovenia

The competitive inequality between the coal, produced in Slovenia (and also that produced in some EU countries) and imported coal has given rise to a thorough restructuring of the Slovenian mining industry in the last decade. This has also resulted in decreasing the quantity of produced coal. The restructuring process is, however, not yet completed.

On the 23rd July, 2002, the EU Council passed Directive No. 1407/2002, regarding governmental aid to the coal industry. The directive includes activities, such as: decreasing the scope of mining (for collieries that are to be shut down before 31st December 2007), aiding the preparation of coal reserves (for mines that are to increase their productivity), aiding the costs of special activities (rectifying the environmental impact of mining in affected

areas). All EU countries will need to comply with this directive, starting from 24th July 2003. The directive will cease to apply on the 31st December 2010.

After the Slovenian accession to the EU, the government will, in compliance with the directive, provide financial assistance to the Slovenian coal mines (Velenje and Trbovlje-Hrastnik). Both mines have achieved important results in their restructuring process.

The Trbovlje-Hrastnik mine will continue to operate until 2007 (inclusive), in the amount of 600,000t. It has, however, already started some of the activities necessary for its closure, as mandated by law.

The mine in Velenje will continue to produce lignite until at least 2025. It is currently being restructured to achieve the following goals:

- 4% yearly increase in productivity
- phasing out all activities not directly related to coal mining
- 2% decrease in coal price
- reducing the number of employees, while at the same time, increasing the number of student internships
- modernising the technological processes used in mining



The long-term decrease in global-warming gas emissions is certainly the biggest challenge for the Slovenian coal mining industry. The Velenje mine has already begun to implement some of its restructuring activities and is on its way to complete the closure of part of the mine (Škala cave), with government aid. As such, it is set to remain a competitive mine, even after Slovenia becomes a full member of the EU.

The demand for non-metallic mineral materials and construction stone looks to remain at its present levels for some time, and no major deviations are to be expected. Technological changes in the mining process are going to occur, however, some have already happened. We expect a move from blasting and underground mining to mechanised mining.

Geotechnology looks to gain importance in the field of underground construction and waste management.

In the education sector, the Department of Geotechnology and Mining (Faculty of Natural Sciences, University of Ljubljana) intends to continue to implement the geotechnology and mining courses, both undergraduate and postgraduate.

The future development of studies at the department is oriented towards unifying the two courses into a single, comprehensive, geotechnology course. Graduates of such a course will cover the entire spectrum of geo-scientific activities.

We expect strong cooperation with other technical schools and universities, as well as a common policy in research and development. The university courses will of course, continue to be rationalised, coordinated and modernised. We also expect to develop specialist expertise, only taught at the Department of geotechnology and mining.

Slovenian membership in European Union is not expected to galvanise major changes in the field of mining and related education. The process of restructuring will continue, but perhaps at a quicker pace. Equally, the establishment of the importance of geotechnology courses and geotechnology experts in construction and waste management is also going to intensify.

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