Summary

The EU mining industry may be part of the solution to Europe's raw material shortage, but sustainability of mining is a key requirement if it is to be revived. Mining and quarrying activities vary widely in profitability, employment and geographical distribution.

In addition to general industrial regulation, the EU has adopted some legislation specific to mining. EU rules concern the environmental impact of mining (especially waste and groundwater), as well as occupational health and safety.

Competitiveness of mining varies across Member States (MS) and across subsectors. The EU requires that state aid to mining cease by 2018. Major challenges for the mining industry include competition for land use, a heavy licensing process and compliance with stringent environmental laws.

The European Commission (EC) promotes sustainable mining through targeted initiatives and research funding.

New technologies focus on finding further deposits in established mines, economically and environmentally viable exploration and processing of ores with low levels of mineral or metal concentration, and reducing mining's surface footprint.

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Mining and quarrying in the EU

Main statistics

Eurostat classifies mining and quarrying activities as the extraction of minerals occurring naturally as:
- Solids (coal and ores);
- Liquids (petroleum);
- Gases (natural gas).

It also includes mining support services, such as exploration by drilling.

About 20 000 enterprises operated in the sector in 2009, employing about 640 000 workers. They generated €72 000 million of value added, resulting in labour productivity of €112 500 per person – 2.7 times higher than the non-financial economy average. Two fifths of staff worked in mining of coal and lignite, while about one third was employed in other activities such as extraction of construction materials. Extraction of crude petroleum and natural gas had by far the highest productivity (€569 000 per person).

Geographical distribution

The UK (oil and gas fields) recorded the highest share (35.6%) of the EU-27 in value added. Other leading producers were Denmark and the Netherlands (natural gas), Germany (construction and manufacturing materials and coal), Poland (coal and lignite) and Bulgaria (metal ores).
Figure 1 - Sectoral analysis, mining and quarrying, EU-27 (% share of total*)

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<th>Sector</th>
<th>Value added</th>
<th>Employment</th>
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<td>Mining support</td>
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<td>Coal &amp; Lignite</td>
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<td>Other mining activities</td>
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<td>Petroleum and gas</td>
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*metal ores mining not available


EU legislation overview

Environmental regulation
Mining operations raise two types of environmental concern: depletion of non-renewable resources and harm to the environment. The latter includes air, soil, water and noise pollution, negative impact on natural habitats, visual impact on the landscape and effects on groundwater levels.

Mining waste
One of the largest waste streams in the EU comes from mining, and some of it is dangerous. The EU legislative framework for the safe management of waste from extractive industries comprises:

- The Mining Waste Directive, introducing obligatory permits and setting requirements for building or modifying an extractive waste facility. If potential risk to the environment or public health exists, operators need to provide a financial guarantee and draw up emergency plans, a policy for prevention of major accidents, and develop safety management systems.

- The Best Available Techniques (BAT) document, on the management of waste from ore processing (tailing) and waste-rock in mining. The BAT promotes activities considered as "good practice".

- An amendment of the Seveso II Directive, covering risks arising from storage and processing activities in mining, particularly tailing ponds and dams used in mineral processing of ores.

Water protection
In addition to poor quality water discharged from operational mines, the environmental impact includes leakage of contaminated water after mine closure. Mine water is covered by the Water Framework Directive which introduces river-basin management with a focus on ecology, and requires that "good" status must be achieved for all EU water by 2015.

It is complemented by the Groundwater Directive, which sets quality standards for underground water and introduces measures to prevent or limit the pollution of groundwater.

Nature protection
The Habitats and Birds Directives shape EU nature conservation policy, a central element of which is the Natura 2000 network of ecological sites. Mining projects in and around Natura 2000 sites are not automatically ruled out, but they must be appropriately assessed if likely to have a significant effect on a protected site. If such effects are expected, mining projects must either be avoided or amended. In case imperative reasons of overriding public interest for a project are established, compensatory measures must be taken. The European Commission has published detailed guidelines on undertaking mining activities in accordance with Natura 2000 requirements.

Assessing environmental impact
Setting up open-pit mines and quarries with a surface area exceeding 25 hectares is subject to a mandatory procedure specified

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in the Environmental Impact Assessment Directive. The competent authority may grant a permit after consultations with environmental authorities and the public, and its decision may be challenged before the courts. Whenever authorities prepare a plan or programme specifically designed to deal with mineral extraction, or where mineral extraction is one of the land-uses considered in the plan, a strategic environmental assessment must be prepared.

Environmental liability
The mining industry is affected by the Environmental Liability Directive which is based on the "polluter pays" principle. Operators have a duty to avert environmental damage or take or finance restorative measures if such damage occurs due to their negligence or fault.

Health and safety
Mining and quarrying has one of the highest rates of accidents at work and of work-related health problems. The occupational Health and Safety at Work Directive sets the general principles for prevention and protection of workers against occupational hazards.

Economic concerns

Competitiveness and challenges
Competitiveness of mining varies across Member States and across sub-sectors. For the non-energy extractive industry (construction and industrial materials and metallic minerals) competitiveness varies more across MS than across the activity type. This may reflect differences in labour costs and productivity among MS. The construction materials sub-sector competes at EU level, while metal mines compete in the global market. Global competitiveness of the non-energy extractive industry may be affected by low social, health, environmental and safety standards in third countries.

In the 2012 European competitiveness report the Commission notes that the mining industry has a pronounced comparative disadvantage in relation to the Rim countries, although multinational enterprises have developed technologies that allow exploitation of natural resources abroad. Both industry and the Commission signalled a need for more detailed and systematic monitoring of raw materials. Geological surveys carried out by the MS need increased mutual consistency, while the introduction of advanced techniques is necessary to create a coordinated joint knowledge base. Another difficulty is competing land uses, mainly related to strict environmental rules (such as
Natura 2000). Start-up costs are higher than in non-EU countries, mostly due to expensive insurance requirements, complex administrative regulations and general administrative fragmentation.

The EU financial sector is more inclined to invest in mining in e.g. the U.S. or Australia, where more financial expertise and capital is available. However, the ratio of non-EU investment in mining and quarrying to added value generated by the industry is above the EU economy average. Numerous mergers and acquisitions indicate that the industry faces changes due to competitive pressure. In the first half of 2012, major European players sought growth through outbound acquisitions.

State aid
In 2010, a Council Decision stipulated that state aid in the mining sector may be given only for the closure of uncompetitive coal mines. It must form part of a closure plan, the deadline of which does not extend beyond 2018. State aid to the coal sector amounted to €2.87 billion in 2010. Recent cuts to mining subsidies and closures of mines as part of austerity measures have sparked protests in some MS.

Revival of domestic mining
The shortage of raw materials, which endangers Europe's competitiveness, has created momentum to consider the development of modern and sustainable mining exploration in the EU. Approximately 70% of the manufacturing sector in the EU depends on mined substances. While Europe is self-sufficient in construction materials and many industrial materials, it is highly dependent on imports of metallic minerals.

Many of the largest known surface and shallow surface deposits have been exhausted, while deeper lying ones have not been fully explored. Estimates indicate that the value of unexploited European mineral resources at a depth of 500-1 000 metres is approximately €100 billion. Modern techniques and higher prices of mined substances now allow the extraction of smaller and lower grade deposits to be economically viable. Moreover, globally the average grade of ore (level of concentration of metal or mineral in the ore) mined economically is constantly decreasing.

According to scientists, Europe has good potential for rare-metal deposits. Historically, low prices of materials made it more profitable to import than to extract, hence some large deposits still exist. Recent exploration in northern Europe has found new deposits which could be extracted by new sustainable mines. However, environmentalists contest decisions which allow mining in areas near Natura 2000 sites. Ecologists are concerned that old infrastructure, such as water reservoirs, may not withstand modern production in cases of abandoned mines being reopened. NGOs point out that the mining activities may harm the economy if their impact on the natural landscape discourages tourism. Local communities and business owners also raise environmental concerns.

EU actions
In 2008, the Commission adopted the Raw Materials Initiative, which proposed improving conditions for domestic extraction of raw materials as one of the three pillars of EU policy. Actions for facilitating sustainable supply of raw materials from European sources included improving access to land for the extractive industry, improving knowledge of mineral deposits and networking among national...
geological surveys, promoting extraction research projects in the Seventh Framework Programme (FP7) and using cohesion policy funding, in particular the European Regional Development Fund (ERDF), to back research, innovation and business-support measures for raw material exploration in remote regions.

The updated strategy, from 2011, recognised that many regulatory issues concerning the extractive industries are in the competence of the MS and the Commission's role is mainly to facilitate the exchange of best practices. New proposed measures included defining national minerals policies, setting up a land-use planning policy using a digital geological knowledge base, putting in place a process to authorise mineral exploration and extraction, and promoting research and development in the raw materials value-chain (extraction, processing and substitution). The strategy also confirmed the use of ERDF and FP7 funding in implementation of the Raw Materials Initiative, and the launch of the Erasmus Mundus Minerals and Environmental Programme to support the training of experts.

In November 2012 the Commission set up a European Innovation Partnership on Raw Materials for targeted innovation and research efforts, breakthrough technologies and multidisciplinary approaches as well as for establishing standards, and reforming public procurement.

The Commission also established an ad-hoc expert group on the exchange of best practices in land-use planning and administrative conditions for exploration and extraction.

EU-funded research

The EU funds research on sustainable mining through FP7. Most of the research and development projects in mining are carried out through the European Technology Platform on Sustainable Mineral Resources, which brings together mining companies, academia, research institutes, geological surveys and associations and is structured around four main priorities:

- Innovative concepts and processes for new high added value mineral products (ProMine, Experl)
- Technologies for sustainable increased self-sufficiency in resources (OneGeology Europe, EuroGeoSource);
- New strategies and technologies for mineral resources extraction, processing and recovery (iMine, ERA-MIN);
- Reducing environmental footprint (EO-Miners, SARMA).

Projects aimed at improving knowledge of existing mineral resources (including those with mining potential) by coordinating and standardising national geological surveys or the earth monitoring include pan-European Geological Data Infrastructure and Copernicus.

Mine of the future

According to the FP7-funded iMine project, the mine of the future will be invisible, safe, and have zero impact on the environment. New sensor technologies will enable autonomous, highly selective extraction at greater depths than today. After the separation process, waste rock and backfill will be stored underground and only the ore and by-products will be transported to the surface.

In the domain of raw materials and for activities related to research and innovation in Europe, the European Investment Bank provides the Risk Sharing Finance Facility. It could be employed to improve access to debt financing for all types and sizes of private companies and public institutions undertaking research, development and innovation projects.
New technologies and concepts

Innovative mining

As many rich ores have been exhausted, the challenge lies in the economic exploration of lower-grade deposits. Bioleaching of ores helps to recover metals through the use of living micro-organisms. Bioleaching extends the life of mines and reduces their environmental footprint.

Beneficiation is a process of crushing extracted ore and separating it into valuable substances and waste. Lower grade ores may undergo a process to increase the concentration of the metal-bearing minerals (so-called flotation).

Using higher resolution geophysics allows more ore deposits to be found in established mines. Rock mechanics, the science of the mechanical behaviour of rock and rock masses, is used for safer deeper mining.

Reducing environmental impact

The use of underground hybrid diesel engines reduces ventilation costs in deeper mines, and storing tailings underground reduces footprint on the surface. Modern working methods, such as progressive extraction followed by rehabilitation of sites, attempt to minimise the land area being worked on at any one time. Mines may also be used for geothermal energy production at the end of their life. Transport costs and environmental impact may be reduced by spatial integration of the new mines (mine-mill-processing plant).

Utilisation of scrap metal, recovery of metals that would have been lost and recycling of mineral waste help to conserve Europe's mineral resources.

European Parliament

In a resolution of 13 September 2011, the EP stressed the importance of stimulating domestic sustainable mining and using new mining technologies. MEPs highlighted the importance of research, development and innovation in developing new methods of mining, ore production and recycling and called on the Commission and MS to develop a digital resource map of the EU. The EP recognised the need for simplification of rules regarding setting up new mines and extraction authorisation processes and urged the Commission to promote discussions on reopening some mines, to reduce the risk of raw materials shortages.

Further reading


*Raw materials reference documents*, DG Enterprise

*Responsible mining in the EU: best practices to overcome the raw materials crisis*, conference, 2011

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Endnotes


3 Rim countries include: Albania, Algeria, Armenia, Azerbaijan, Bosnia and Herzegovina, Egypt, Georgia, Israel, Jordan, Kosovo, Lebanon, Libya, Liechtenstein, Moldova, Morocco, Norway, Palestine, Russia, Serbia, Switzerland, Syria, Tunisia and Ukraine.