

Mining

General

Finland has a long history of mining activity, and Finnish metallurgical technology and manufacturers of mining equipment are well known throughout the international mining community. The exploitation of copper, nickel, cobalt, zinc and lead ores as well as chromium, vanadium and iron deposits has provided the raw material base for the country's metal industry, with significant processing and refining of copper and nickel concentrates at Harjavalta, zinc at Kokkola, and chromium at Kemi, and of iron at Raahe. The major industrial minerals mined in Finland are carbonates, apatite and talc.

Technologies and skills have been developed to find and treat ores into metals and final products many of which are of world class level. These technologies and skills now form the basis for the extractive industries themselves and for part of the downstream industries. Mining equipment manufacturing, engineering and earth science services are sectors with great future potential.

During the last decades the country specific socio-economic and political situation determined to a large extent also developments in the extractive sector. A few key specificities can be summarised:

- Traditional industrialisation based on domestic resources forests and later metals
- Lack of energy resources
- Home-grown strategy with emphasis on internally generated capital, raw materials and skills
- Extensive government involvement.

Today a more comprehensive approach is widely adopted.

Finnish extractive sector consists of two completely different sets of companies:

- The many small quarry and sand/gravel pit operators
- A handful large companies operating metal and industrial mineral mines.

These two sub-sectors have very different status in all respects: economically, socio-economically, resources to deal with problems and to take advantage of opportunities, culture and traditions. These differences contain opportunities to feed ideas into the development of each of the other sectors. The dynamics of small and big, entrepreneurs and local growth opportunities; the potential to develop personally and economically is another side of the regional aspects. The initial stages of mining are more and more done by entrepreneurs, so called junior companies, well suited for small businesses.

The Finnish extractive industries, in particular the metal mining sector and the equipment manufacturers, have a solid reputation internationally and nationally. The whole sector compares favourably to its international peers, both technically, economically and environmentally and in terms of the health and safety situation.

Mineral Policy

General views:

The mining sector has experienced a large turbulence in past few years. After a long period of lacking demand and low price industry has globally experienced a rapid growth on demand and prices. Despite of present recession, the mining sector will have a growing role in the world economy.

An adopted mineral policy is challenged through the fact that the global exploration and mining scene is changing fast. It might become necessary to review the policy once again in light of the latest changes.

Competition is today's phenomena. Several countries are competing with each other in terms of providing more favourable conditions for the international players and exploration investments.

Mineral policy includes a wide range of working areas:

- knowledge in basic geological research
- development of new exploration methods
- geological mapping and evaluation of raw material resources
- mining and extracting technologies
- machinery and equipment
- new, ecologically more advanced technologies and new materials
- change of living habits towards less material consuming direction

In the long run the demand of raw materials will inevitably increase. The increased globalization of world commodity markets has reduced the perception of policy makers that it is a necessity to achieve national self-sufficiency in minerals. Previously the substantial growth of environmental awareness made mining less popular.

Also European Union is worried about its future access to and prices of raw materials. The European Commission has on November 2008 given a communication on critical raw materials. The proposals are based on three pillars: 1) measures on foreign trade and development policies, 2) measures to encourage supply of raw material in European union area 3) measures for developing saving and sustainable technologies and practices.

In times of focus on sustainable development the extraction of metals out of limited ore bodies is wide open for criticism. No matter how elegantly the need for metals and minerals is argued. The mining industry is facing complicated times all around the world and possibly worse in Europe than elsewhere.

A national policy framework is composed of many policies, some of which are interlinked. Determining which policy has precedence may be difficult. To the extent possible, the mineral policy should state its relative relationship to other policies.

With regard taxation and administrative fees the mineral policy should identify the major forms of taxes payable by a mineral venture and describe, generally, the major types of incentives and deductions allowable for computing taxable income.

Legislative framework

There are many legislative framework issues that can be included in a national mineral policy. Typical discussion points are:

- a) Applicable laws
- b) Exploration/mining rights regulatory approach
- c) Exploration and mining application priority
- d) Security of tenure

A review work for overall reform of the Finnish Mining law is in process. The purpose of the work is to revise the current mining law with modern legislation ensuring the preconditions for mining and ore prospecting in a socially, economically and ecologically sustainable manner.

The proposed new Mining Act would take account of environmental issues, citizens' fundamental rights, landowners' rights and the municipalities' opportunities to influence decision-making, while ensuring the preconditions for prospecting and mining operations. The Mining Act would reconcile various public and private interests so that, as a whole, insofar as possible, the Act would secure the simultaneous materialisation of competing interests.

Outlines for Government Financing for Mining Undertakings

Mineral policy also includes guidelines and criteria for state contributions to the financing of mining projects. According to the Government's policy definition, a project to be supported with governmental activities shall be of such magnitude and long-term duration that its impacts in terms of the national economy, regional economy and employment are significant. Financing shall be based on the project's positive socio-political and financial cost-benefit ratio.

There are good grounds for the Government to promote the establishment of mines, because new mining operations can consequentially influence regional financial development and employment. Mines operating in Finland also reinforce the nation's basic raw material resources and security of supply.

The role of Geological Survey

One of the main duties of the Geological Survey of Finland (GTK) is to promote mineral exploration and mining in Finland. GTK is responsible for acquisition and management of geoscience information in Finland, with a particular emphasis on providing high quality data to the exploration and mining sector. Through a comprehensive mapping and research program, GTK also identifies and documents areas with mineral potential, in order to encourage follow-up exploration and exploitation by the private sector, with the aim of supporting sustainable use of both bedrock resources and surficial deposits. All GTK discoveries are offered to the private sector through an open tendering process arranged by the Ministry. Neither the Finnish Government nor GTK have any role in the downstream development of mineral deposits.

Environment

Environmental protection has for some decades been focusing on emissions. The mining industry has been actively reducing its emissions of metals and waste water. The absolute amounts are today low and mostly negligible from a national perspective. In an international comparison the Finnish extractive industries are at the forefront both technologically and in its systematic approach.

The Finnish mines and quarries are however still emitting more than the average of Finnish industry when relating to value added in the sector. There is still a lot to do to reduce emission but this is now routine work and there are effective ways of systematically dealing with these problems. In recent years the focus of environmental research and worries for the future has instead shifted to two new issues

- Land use
- Biodiversity

The reasons for this are firstly that the emission problems have to a large extent been tackled, at least when it is practical to do so, and secondly more comprehensive understanding of the global mechanisms controlling the biology and ecology of planet Earth has lead researchers to these new areas. In Finland this means that there is a general consensus among government representatives and environmental researchers that the mining & quarrying sectors do not pose serious environmental problems. The extractive industries cover only a minor part of the land area of Finland. This puts the mining industry in a new light among the evolving environmental priorities.

Energy

The emissions from the mining and even from the metallurgical industries are not at present posing any major problems or threats to Finnish environment or the health and well-being of Finnish citizens. The one major issue that is raised lately issued is the high energy consumption of the mining and metallurgical sector. This needs to be further evaluated. It is important to understand what is the real energy efficiency in these sectors compared to international peers.

R&D policy

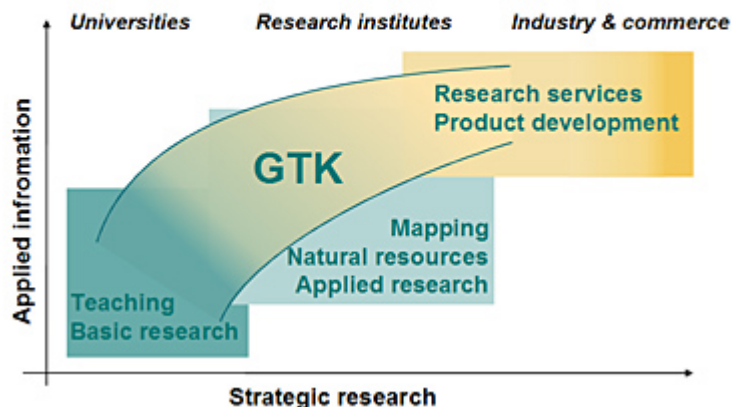
Mining is one of the base industries, which are all characterized by a high level of experience and knowledge collected over many decades. It is absolutely critical that suitable amounts of government R&D funds are channelled into the extractive industry sector.

Key agencies

Tekes, the Finnish Funding Agency for Technology and Innovation has a wide experience of successful project such as the Intelligent Mine and Wasteless Mine and Integrated Risk Assessment of Metals in Finland.

As a government agency GTK plays a vital role in providing geological expertise to government, industry and the wider community. Specific responsibilities include the promotion and implementation of sustainable approaches to the supply and management of minerals, energy and construction materials, and to ensure environmental compliance through monitoring, assessment and remediation programs. GTK also contributes to a wide range of international geoscience mapping and environmental monitoring projects and is active in developing multidisciplinary research programs with universities, government agencies and stakeholders across related sectors.

GTK's role within the national R&D framework



Health and safety

Accidents

Conventional wisdom sees mining as a heavy, dark and dangerous job. This was certainly true in the past but the situation has changed completely in recent decades. Most activities are nowadays carried out by machines, which give workers protection against dust, fumes and injuries and also carry out the heaviest tasks. The accident level is hence considerably lower in the extractive resources industry than in other branches of industry.

Work environment and occupational diseases

Perhaps the most important effect of mechanization is the general improvement of the work environment for miners. The vehicle or automated machine often has a ventilated and heated cabin from which the process is controlled. Further the machines used also diminish work related musculo-skeletal disorders, which were earlier more frequent. Ventilation in the mines has been gradually improved and more fresh air reduces the risks for occupational diseases due to dust and particles. There is still a lot to do but the starting point is advantageous.

Occupational diseases, which were/are common in metal mining industries world wide, such as pneumoconiosis and silicosis have been completely eradicated in Finnish metal mining.

In the EU-funded project "Occupational Safety in Vocational Mining Education"

(by the Kemi-Tornionlaakso Municipal Education and Training Consortium Lappia, the Finnish Institute of

Occupational Health and the Kirovsk Technical College)

The parties collaborated to produce training materials, in Finnish and in Russian, on occupational safety in mines. Together with well prepared periods of on-the-job learning carried out at mining sites, the training material provides the student with basic competencies for operating safely in different mining tasks. Altogether 25 experts on occupational safety from Finland and Russia participated in the production of the training material. The training material was evaluated and further developed in thematic categories in four joint expert seminars. The training material was piloted in vocational training institutes in Tornio and in Kirovsk. The feedback on the pilots received from the teachers and students was generally positive. The joint visits of the project

partners to the Outokumpu Chrome Oy mine in Kemi and to the mines and concentration plant of Open Joint-Stock Company Apatit, in order to learn about their operations and occupational safety, brought the Russians and Finns closer together in their thinking about safety matters.

Case study: Operate safely

Pyhäsalmi is an underground copper and zinc mine located on Lake Pyhäjärvi in central Finland. It produces three types of concentrates: copper, zinc and pyrite.

Pyhäsalmi's safety and health management system was certified under the Occupational Health and Safety Assessment System (OHSAS) 18001 standard.

Pyhäsalmi continued to update safety management systems, resulting in dramatic improvements to safety statistics and continued improvements to leading safety indicators. Protection training and systems were improved following a fall hazard assessment. ELMERI, a workplace safety inspection system developed by the Finnish Institute of Occupational Health, continued to be used as the primary workplace inspection tool (access information on ELMERI at www.ttl.fi/Internet/English/Advisory+services/Occupational+Safety/). A staff member was appointed to ensure that ELMERI inspections occur monthly as planned and that corrective actions are implemented as needed.

Finnish and European Union law requires employers to assess the safety and health risks of certain workplaces. Pyhäsalmi made progress on this assessment work in 2007, part of a continuing process that will also help the operation train employees and contractors about how to do their jobs safely.

The 2007 safety performance was exemplary. Both LTIF and DIF decreased 83 percent and incident severity decreased 74 percent from 2006. TIF declined 45 percent year over year. Considerable emphasis was placed on improving contractor and employee safety by strengthening training. Contractor training increased to nearly one shift per contractor and employee training increased by more than 150 percent over the comparable 2006 values. The number of safety meetings increased nine percent and workplace inspections increased 16 percent. Job safety analyses decreased by more than 50 percent in 2007 as the site completed its campaign of task-related risk assessments. The assessments will be reviewed periodically, when jobs change and as new jobs arise.

Pyhäsalmi also played an active role in the company Safety Task Force and HCP Workgroup.

Best practices & guidelines

ProMine Project (Nano-particle products from new mineral resources in Europe):

The non-energy extractive industry (NEEI) is a significant contributor to the economy of the EU providing metalliferous and non-metalliferous mineral resources to the society as well as direct and indirect employment. The philosophy behind ProMine is to stimulate the extractive industry to deliver new products to manufacturing industry.

Main objectives of the project:

- To develop the first pan-European GIS-based database containing the known and predicted metalliferous and non-metalliferous resources, which together define the strategic reserves (including secondary resources) of the EU
- To calculate the volumes of potentially strategic metals (e.g. cobalt, niobium, vanadium, antimony, platinum group elements and REE) and minerals that are currently not extracted in Europe
- To develop five new, high value, mineral-based (nano) products
- To enlarge the number of profitable potential targets in Europe
- To establish a new, cross-platform information group between the European Technology Platform on Sustainable Mineral Resources (ETP-SMR) and other platforms.

The ProMine consortium led by Geological Survey of Finland (GTK) includes 27 partners from 11 EU member states. Industry partners in the ProMine consortium produce more than 70% of metals in the EU, so implementation of results from the project will translate into direct and significant economic benefits.

Exploration and Mining in Finland's Protected Areas, the Sami Homeland and the Reindeer Herding Area: guide

This guide describes the conditions for exploration in Finland's protected areas. It is intended for exploration and mining companies, and for permit and supervisory authorities. The guide also describes the most important matters to be considered when carrying out exploration and mining in the Sami Homeland and the reindeer herding area in northern Finland. The ecological values of the areas and the legal basis for their protection determine what measures can be carried out in each area.

The guide is in two parts. The first chapters sum up the legal basis for exploration, describe the different types of protected area, and the principles and procedures for exploration in protected areas and the Sami Homeland. The appendices give a detailed description of the protected areas and the exploration and mining process. They also give instructions on how to apply for claim rights and survey permits in protected areas. The purpose is to provide the prime target groups (Finnish and foreign exploration and mining companies, and the permit and supervisory authorities) with all the necessary facts.

Mine Closure

The planning and implementation of mine closure are constrained by legislative requirements that define criteria and objectives for closure, as well as dictate responsibilities and sanctions. In addition to legislation, principles of sustainability, good practice and environmental management systems provide guidelines for closure. The wide variety of raw materials mined and the differences in operations are reflected in mine closure planning and

implementation. The selection of methods employed is dependent on e.g. the nature of the deposit and the production process, the type and properties of the by-products and the environmental conditions at the site. The selection of methods must be based on site-specific considerations.

As a result of a three-year national technology project, the Green Net Mining (GNM) group produced a comprehensive mine closure handbook. The handbook is designed to assist mine operators and environmental agencies in developing strategies for closure planning in accordance within European Union jurisdictions. Topics covered in detail include regulatory requirements, potential types of impacts and their assessment, risk management, economic considerations, best practice procedures and instructions for preparing a successful closure plan. Extensive description of closure-related R&D at an operating nickel mine provides the handbook with invaluable reference material and solutions from a real-life case study. The GNM was recently joined by another major European metal producer, Sweden's Boliden AB.

Guidelines for the Environmental Impact Assessment Procedure for Mining Projects

This report was provided by the Ministry of Employment and the Economy.

All mining projects in Finland need at least an environmental permit, which goes beyond the demands set by the EU's integrated pollution prevention and control directive (IPPC). Further, larger projects are in need of an Environmental Impact Assessment (EIA), which also can be demanded based on a case specific assessment for projects not exceeding thresholds.

EIA is one of the key instruments of environmental policy in the European Union. It has been adopted to obtain information about the effects of development proposals so that environmental damage can be avoided or minimized. In the European Community, environmental impact assessment is required under EIA Directive 85/337/EEC.

This guide provides to the mining society environmental consulting from the beginning to the end of mine. It helps to evaluate an Environmental Due Diligence assessment when mining projects are developed or an existing mine further developed. This guide advises on business and project challenges and risks presented by environmental and operational issues. It helps both industry and authorities by providing up-to-date knowledge.

It covers environmental monitoring, like water controlling, dust and noise measurements. It also includes rehabilitation planning, contaminated soil investigations and remediation planning. The purpose of this guide is to generate well-organized information to assess environmental character of the proposed operation or activity.