ENGLISH VERSION

# Increased Demand for Metals and Minerals – Strategies and Conflicts of Objectives and Interests

A component report of the IVA's *Roadmap for Metals and Minerals* project

IVA
Royal Swedish Academy of Engineering Sciences

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Published by: The Royal Swedish Academy of Engineering Sciences (IVA), 2024
Box 5073, SE-102 42 Stockholm, Sweden
Tel. +46 (0)8 791 29 00

IVA publishes various types of reports within the framework of its activities. All reports are fact-checked by experts and then approved for publication by IVA's President.

IVA-M 556
ISSN: 1100-5645
ISBN: 978-91-89181-61-8

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This report is available to download as a pdf file at www.iva.se

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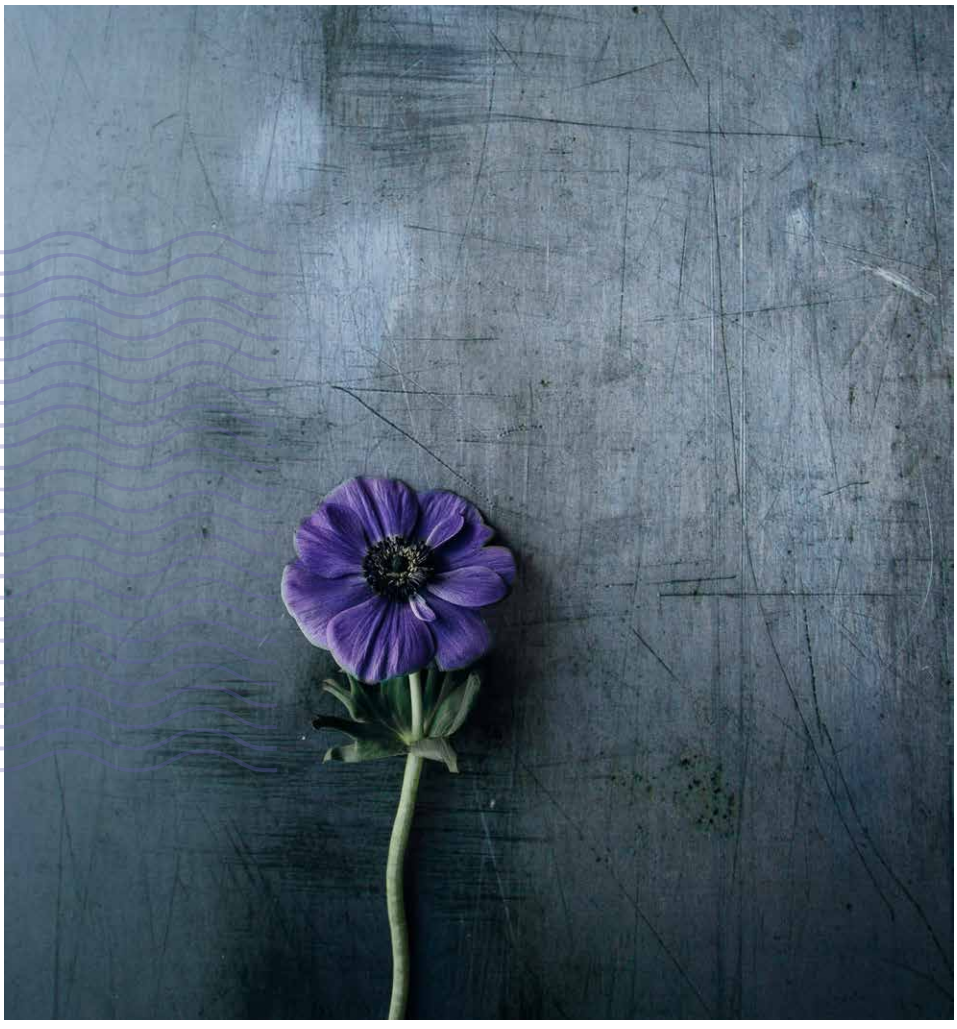

# 1. Foreword

»This report focuses on the political challenges that the EU and Sweden face in managing the supply of ‘new’ metals and minerals, which will now be used on a much larger scale than before.«

The transition to a fossil-free, sustainable society will require the increased use of metals and minerals that have not been widely used before, and that are essential for the technology involved in wind turbines, electric cars and the rapid development of information and communications technology. Demand for several of these critical metals and minerals is expected to increase signficantly in the coming decades.

The IVA's *Roadmap for Metals and Minerals* project aims to help Sweden and Europe secure long-term, sustainable access to the critical metals and minerals needed for a transition to a fossil-free, sustainable society.

This is the third of four reports within the project. The other reports are '*Challenges for Meeting Increased Demand for Metals and Minerals*', '*Circular Flows to Meet Increased Demand for Metals and Minerals*', and the final report '*Metals and Minerals for Sustainable Development and Strengthened Competitiveness*'. The first three reports form the basis for the conclusions and recommendations of the final report.

This report focuses on the political challenges that the EU and Sweden face in managing the supply of these 'new' metals and minerals, which will now be used on a much larger scale than before. Sweden has just begun the process of developing a new minerals strategy, and the report discusses the policy areas and issues that should be included in it. We show examples from other countries' strategies, and discuss the framework that has been provided for the Swedish work by the EU's recently adopted Critical Raw Materials Act.

The issue of permitting processes, especially environmental assessments, occupies a significant part of the report. We aim to re-energise the debate on environmental assessments; we do this by highlighting the strengths and weaknesses of the current structure of these assessments. We also address the conflicts of interest and objectives that arise in the context of environmental assessments, and the role that national policy must play in resolving them.

The report was prepared during 2023–2024 by an expert group consisting of:

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The expert group has analysed and discussed conditions, challenges and measures linked to strategies, goals and conflicts of interest for the IVA's *Roadmap for Metals and Minerals* project, using factual reports, studies and scientific articles as a basis. The report is also based on the expert group's collective knowledge and analysis, and provides input to the continuing debate – as highlighted in the text with an exclamation mark (!).

The expert group supports the report as a whole, but not all individual statements.

**Project funders:** ABB, Epiroc AB, LKAB, Ragn-Sells, Sandvik AB and Zinkgruvan Mining with support from Mistra (Foundation for Strategic Environmental Research), the Swedish Foundation for Strategic Research (SSF) and Swedish Mining Innovation, a joint initiative of Vinnova, Formas and the Swedish Energy Agency.

Stockholm, May 2024

**Gert Nilson**, Expert Group Chair

# 2. Summary

»A reliable supply of critical metals and minerals is a basic requirement for the transition to a fossil-free, sustainable society. This report discusses the political dimension with an in-depth look at permitting issues.«

A reliable supply of critical metals and minerals is a basic requirement for the transition to a fossil-free, sustainable society through electrification and digitalisation. Many technical issues need to be addressed, and there are also significant challenges of a political nature. This report discusses the political dimension with an in-depth look at permitting issues.

When different countries, or a union of countries such as the EU, are to pursue policies and design strategies to implement the transition to a fossil-free, sustainable society, this is done based on a number of conditions. One is to manage the varying capacity of the market to create the conditions for producing the goods and services needed for the transition. Strategies must also cover geo-, trade- and security-policy issues affecting livelihoods.

The report draws on examples from several countries' strategies, which describe the starting point regarding access to metals and minerals that have not been widely used up to now. This is often done in terms of strengths and weaknesses.

These strategies also address the need for investment in research and innovation, in strategic projects, and in skills supply. Investments in circular flows are present in all of the strategies, and measures aimed at achieving environmental, economic and social sustainability are also prominent. The strategies cover a wide range of policy areas such as research and education, industrial policy, and legislation and its application in exercising public authority. Issues of social acceptance and indigenous peoples' rights are also central.

The EU's Critical Raw Materials Act (CRMA) came into force in March 2024, with the aim of creating the conditions for a secure supply of certain raw materials in the Union. The list of selected raw materials includes metals and minerals that are important for the technologies central to the transition to a fossil-free, sustainable society. Since the CRMA is a Regulation, meaning that its content must be directly applied in each EU Member State, it provides a framework for Member States' mineral strategies. The CRMA entails several obligations, but does not cover all the policy areas that should be included in a national strategy. Preparation of a new mineral strategy for Sweden began in March 2024.

Permit reviews are central to the transition to a fossil-free, sustainable society. They can also be seen as a catalyst for discussing how a democracy should balance different societal interests. In Sweden, opening a new mine requires approvals under the Environmental Code, the Minerals Act, and the Planning and Building Act. Environmental assessments in particular are the subject of critical discussion, but at the same time can be seen as our democracy's way of dealing with difficult and complicated conflicts of interest and objectives in a transparent and predictable way.

Representatives of operating companies and the licensing authorities were asked about their views as part of a government inquiry into improving environmental assessments. There was broad agreement that there are shortcomings in how the processes are carried out. It is also possible to trace a relationship between the operators' criticism of passive action by the county administrative boards, and the authorities' statement that there is a lack of resources. There is also agreement that there are shortcomings in the review documentation. The companies also believe that there is uncertainty about changes in licensable activities, as they consider that assessments of these often focus too much on inspection issues while too few sustainability aspects are assessed.

The processing times taken for environmental assessments are controversial. The Swedish Environmental Protection Agency (Naturvårdsverket) compiles statistics on these; data for 2020–2022 show that 80% of permits were granted in line with the initial application. The median time taken was just over a year. It is difficult, however, to make a

precise assessment of the total processing time for those cases where an appeal was lodged. A conservative estimate shows that it varies between about four and just over seven years. There were few assessments for metal and mineral activities in 2020–2022, with the processing times for these being longer than for other cases.

The issue of more aspects of sustainability in environmental assessments has been raised in the public debate on permitting processes. Ideas have also been put forward to create 'green channels' for projects of particular importance for the transition to a fossil-free, sustainable society. These proposals have been met with scepticism both in scientific literature and governmental investigations, where it has also been noted that Sweden's Environmental Code already provides some scope for considering various sustainability aspects in an environmental assessment.

Sweden has a strong mining tradition, but we are only just starting the process of exploiting a number of deposits of critical metals and minerals. EU cooperation, formalised in the Critical Raw Materials Act, puts pressure on Sweden to explore and to create opportunities for realising our geological potential. A number of conflicting objectives and interests will come to light as this happens, and will be managed within the framework of various permitting processes, not least of which are environmental assessments.

If Sweden chooses to mine increasing amounts of metals and minerals, this will mean new mining operations. This in turn creates conflicts of objectives. The first is between leaving nature untouched, and accepting local environmental and social impacts. The second conflict of objectives concerns sustainability, the environmental impact, and the working conditions we are prepared to accept in mining operations outside Europe. The third concerns the balance between investments in Sweden and outside the EU.

Resolving issues of competing land use, not least in the supply of critical metals and minerals, is fundamentally

about complex conflicts of objectives at the societal level. Resolving these issues requires national priorities that can be translated into local decisions. Today, there is no formalised cross-sectoral collaboration, and common data and analyses are made from a holistic perspective. Current legislation allows trade-offs to be made between different societal interests within the framework of environmental legislation. All the same, these trade-offs require clear national guidelines that can inform decisions at the local level. Such guidelines are currently lacking.

Establishing a mine always has environmental, political, local, economic and social dimensions. Sweden has long chosen a path whereby municipalities do not receive any direct financial benefit from a business establishment or infrastructure investment, such as hydropower, apart from the tax from the employees registered in the locality. If municipalities are to derive direct economic benefits from an establishment, many of the employees must live there. For this to be attractive, housing and good social services are needed. In many cases, this means investment and risk-taking for municipalities. There are proposals for increased value-sharing with the local community (to increase acceptance of a mining project in the local area) and for a mining pot within the framework of the state budget to strengthen municipalities' finances.

A number of possibilities and proposals currently exist for increasing local social acceptance. In addition to financial compensation, it has been suggested that the Minerals Act should introduce a requirement for early dialogue meetings. It is also proposed that holders of exploration permits should compensate affected property owners, such as forest owners, for the work required to bring about an early dialogue meeting.

There are significant differences in the resources available to different groups to put forward their case when conflicts of interest relating to environmentally disruptive activities are to be handled, not least in terms of the legal processes involved.

# 3. Policy challenges and conditions

»The availability of critical and strategic metals and minerals depends on geological conditions, global geopolitics and market conditions.«

Managing the transition to a fossil-free, sustainable society requires technological solutions in which critical and strategic metals and minerals are a fundamental requirement (IVA, 2024a). A number of conditions apply when individual countries or a union of countries (such as the EU) pursue policies and formulate strategies to implement the transition. The varying capacity of markets to create the conditions for producing the goods and services needed for the transition must be addressed. Strategies must also cover geo-, trade- and security-policy issues affecting livelihoods.

In this chapter, we discuss these issues. In Chapter 4, we provide examples from different countries' mineral strategies. Chapter 5 describes the EU's Critical Raw Materials Act (CRMA) as a framework for European countries' strategies.

Permit assessments, especially environmental assessments, are central to the transition to a fossil-free, sustainable society. They can also be seen as a catalyst for the discussion on how a democracy should balance different societal interests. The report's emphasis, in Chapters 7–9, is on environmental assessments and the conflicts of objectives and interests that often become apparent in connection with them.

## Geology and markets

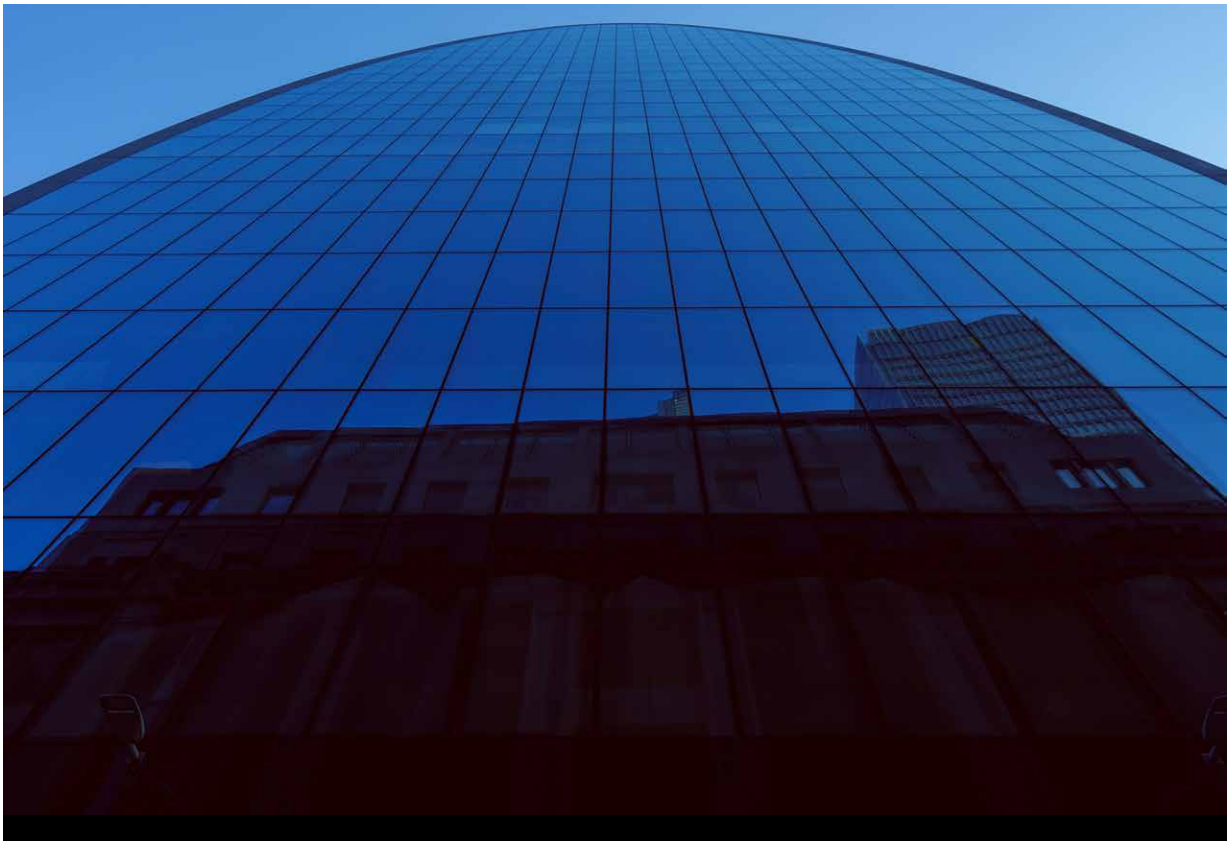
Europe's supply of critical and strategic metals and minerals poses policy challenges. We need to manage our dependence on a few countries, especially China. It is also essential to stimulate the extraction and recycling of critical and strategic metals, even when there are no functioning markets for some of them (IVA, 2024b).

The availability of critical and strategic metals and minerals depends on geological conditions and the nature of value chains. Many of the metals and minerals included in the EU's list of critical and strategic raw materials are by-products of ferrous- and base-metal mining. As such, they only make up a small proportion of the minerals involved.

Market conditions are different for those metals and minerals that are mined in larger volumes, while market turnover for some critical and strategic metals and minerals can be a fraction of that for ferrous and base metals. This makes it difficult for companies to make investment calculations based solely on developments in these existing, often inefficient, low-volume markets. A single investment can dramatically change global market conditions and prices, and as a result can derail the entire investment (IVA, 2024a).

## International relations and markets

With just a few countries accounting for most of the world's production, global geopolitics affect how the EU and Sweden can manage their supply of critical and strategic metals and minerals. China plays a dominant role in producing and processing many of them, controls large parts of the value chains, and is also a major net importer (IVA, 2024a).



The changing trade and security policy situation affects the conditions for the supply of strategic metals and minerals. The issue is not new, however; as early as 2010, a dispute led China to suspend its exports of critical metals to Japan (Evenett & Fritz, 2023). In 2023, China also restricted the export of certain raw materials, citing national security interests. Export controls on gallium and germanium were introduced, along with licensing requirements for the export of selected graphite products, citing their military importance (Andersson, 2023).

Protectionist tendencies and a division into trading blocs have replaced a long period of globalisation. The US Inflation Reduction Act has the stated goal of favouring domestic industry and foreign companies that choose to operate in the country. The Act reinforces these protectionist tendencies by giving preferential treatment to companies setting up in the United States at the expense of those seeking to export to the country. The heightened tensions resulting from Russia's invasion of Ukraine have also very quickly placed the supply of raw materials high on the security and preparedness agenda (Rossbach, 2023).

## Politics and the market

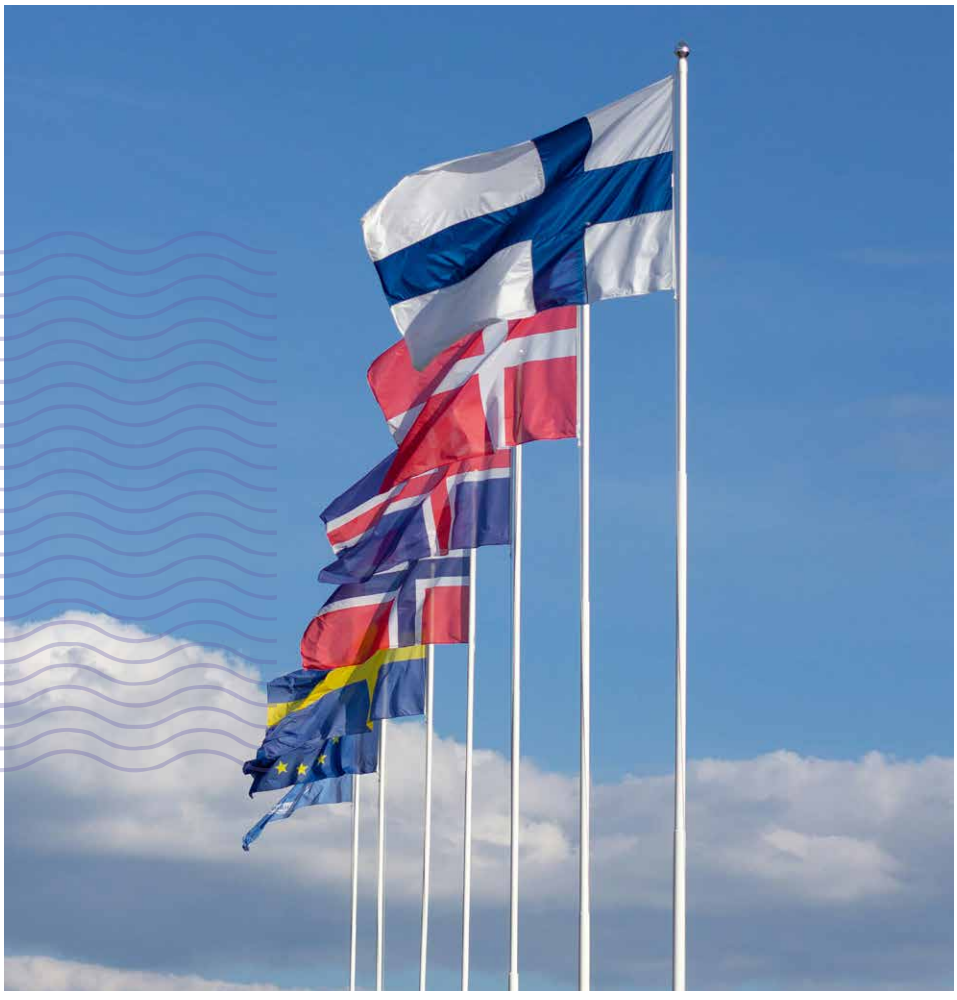
In market economies such as Sweden and other EU countries, prosperity is created by the market's ability to commercialise new technology through innovation, thereby creating economic value. Creating good conditions for research and entrepreneurship has been an important po-

litical task ever since the beginning of industrialism in the 19th Century (Schön, 2014). At the same time, politics must channel the interests and goals of different groups for societal development, where economic resources, based on various political perceptions, benefit all the groups in society as much as possible.

One of today's critical political tasks is to drive the transition to a fossil-free, sustainable society. That presupposes that companies' calculations in the form of estimated revenues and costs are such that they choose to produce the goods and services that allow that transition to happen.

Because of what economists call market failures, these conditions are often not in place for the companies responsible for supplying critical metals and minerals (IVA, 2024 a). This can mean that the market's pricing of a product or service means that it is not produced, even though it can be a great benefit to society. A market failure can also mean that the socio-economic costs of an environmentally harmful activity are not reflected in the price.

Addressing market failures through policy measures is a delicate task. A balance must be struck between, on the one hand, exploiting the market's ability to create efficient resource utilisation and to stimulate innovation, and on the other, using incentives and regulations to ensure that the goods and services that are of vital interest to society are produced.



# 4. Mineral strategies – an international perspective

»Many countries and regional groups are working on strategies to supply critical metals and minerals. Most of them have a broad approach and cover many policy areas.«

Many countries and regional groups are working on strategies to supply critical metals and minerals. In this chapter, we look at aspects of how Australia, Brazil, Canada, Finland, Japan, Norway, South Korea, the United States and the African Union are approaching this.

An offensive approach emphasising their opportunities characterises the strategies of Australia and Canada – both major mining countries (Australian Government, 2023; Government of Canada, 2022). The United States' strategy addresses the country's low level of self-sufficiency in metals and minerals essential for the transition (U.S. Department of Commerce, 2019).

In Brazil, another important mining nation, a key issue is how to move up on the value chain (Pope & Smith, 2023). The African Union is working on similar problems, with the aim of presenting its strategy in 2024. A key issue is how member countries' economies can benefit from a greater part of the value chains than is the case today (African Development Bank Group, 2022). In South Korea, which has no mineral resources, the strategy focuses on managing the supply of critical metals and minerals through imports (Sharma, 2023). Like Japan, South Korea has worked continuously on its supply security since the 1950s.

Most of the strategies discussed here have a broad approach and cover many policy areas. They describe each country's geological conditions, and the strengths and weaknesses of its industrial capacity. The strategies also address the need for investment in research and innovation, strategic projects and skills provision. Investment in circular flows appears in all of the strategies, while measures to achieve environmental, economic and social sustainability are also central to many of them.

This chapter looks at different countries' strategies. The aim is to use examples to show that the fundamental issues surrounding the supply of metals and minerals are often shared. However, the focus differs – depending on the country's resources and its domestic processing of critical and strategic metals and minerals.

Of the Nordic countries, only Norway has a strategy aligned with the EU's Critical Raw Materials Act (CRMA), and this only dates from 2023 (Ministry of Trade, Industry and Fisheries, 2023). Sweden and Finland are currently working on renewing their mineral strategies. The section *Strategy work in Sweden and Finland* (later in this chapter) describes the status of these updating projects as of spring 2024.[1]

## National conditions guide strategy planning

The strategies describe the starting point regarding access to mainly 'new' metals and minerals – those that have not been extracted on a large scale before. This is often done in terms of strengths and weaknesses.

The availability of metals and minerals in Australia and Canada is excellent. The opportunities for extraction are considered very good because their mining industries are technologically advanced and robust. The focus is, therefore, on taking advantage of the mining industry through increased production, and by accommodating and developing more parts of the value chains within the country.

Brazil has good access to critical metals and minerals. However, the structure of the Brazilian mining industry has so far

1 Unless otherwise stated, the references in this introductory section form the basis for the examples from different countries' strategies in the chapter.

prevented the country from benefiting economically from mastering several stages of the value chains. Comments in the national debate on the strategy note that one reason is that the country's role in the green transition is not sufficiently defined.

The United States has abundant resources of metals and minerals that are only extracted to a limited extent. The country is almost entirely dependent on imports, not least from China. Hence its strategy is to gain more control over the supply of metals and minerals, both through increased domestic production and by having more links in the value chain under national control. Another way is through international agreements such as the Mineral Security Partnership, which includes 14 countries, including Australia, Canada, South Korea and Sweden, together with our Nordic neighbours, Finland and Norway.

The focus of the strategy is clear for South Korea, which has no metal and mineral resources of its own. The task is to minimise risk and to secure access to strategic metals and minerals for its industry. South Korea also directly supports other countries through investment in the sector. The challenge is to secure its supply in the face of global competition and geopolitical tensions between the United States, China and Russia.

Norway sees its strength from a Nordic perspective through the combined availability of metals and minerals in its own country, and in Sweden and Finland. It has also identified opportunities for extracting resources from mining waste and from minerals on the Atlantic seabed. Planning for this initiative (which the European Parliament and others have criticised) began in 2024.

## Research, development and innovation

In their strategies, the countries considered here want to invest in research into processes for extracting new metals and minerals. The US's strategy emphasises the need for research to find alternatives to the difficult-to-access metals and minerals currently used in the technology central to the transition to a fossil-free, sustainable society. This is also one of several important areas in Australian and Canadian strategies.

A variety of measures and initiatives are used for implementing the initiatives. Canada has allocated specific budgetary resources for basic geological research, strategic R&D projects, and funds to develop technologies and processes for extracting new metals and minerals. It has also introduced a 30% tax credit for exploring for designated critical metals and minerals. US strategy also emphasises creating conditions for academic research and academic-industry partnerships.

Norway notes that its research efforts in this area have so far been limited, but it does not propose any special initiatives within the framework of the strategy.

## Strategic projects and infrastructure

Australia and Canada, in particular, identify investments in strategic projects as being essential elements of their strategies. Government investment is to be made in particularly high-risk projects, such as exploration, processes for extracting critical metals and minerals, and recycling and circular solutions. Both countries have large numbers of 'junior' and exploration companies with no mining revenue that can benefit from government investment and venture-capital market financing. These companies also have exploration projects in many countries outside of their own.

Canada's strategy focuses on improving various aspects of its infrastructure; for example, in areas currently only supplied with electricity from diesel generators. Canada also identifies measures to stimulate the emergence of clusters and hubs that can increase international competitiveness through foreign companies investing in the country, while Australia sees significant projects that can attract foreign investment as being strategic. Both countries' strategies link the efficiency of their permitting processes to the challenges of implementing strategic projects.

In addition, Australia and Canada have a set of tools to achieve their strategies' long-term objectives. These include earmarked budgets, tax reductions for exploration, centres of excellence, and advisory services. In the latter category, both countries have initiatives to assist companies in dealing with authorities in relation to regulatory issues and financial support.

The US does not identify specific strategic projects and relies more on broad research initiatives. Norway refers to the CRMA strategic projects.

## Circularity

Circular flows are essential to most of the strategies we discuss. Australia has set targets and action programmes for increased circularity in the management of metals and minerals by 2030. Canada offers government funding for industrial initiatives that include circular flows.

The US's strategy includes specific research initiatives for recycling and circular processes. Based on the CRMA, Norway's strategy devotes considerable space to various circularity issues.

## Skills supply

Many mining nations' strategies raise the issue of skills. The aim is to ensure the availability of labour in all functions related to mining activities. The description of the problem often highlights shortcomings in research, together with a general decline in interest in studying mining-related courses at universities and colleges. According to the Canadian strategy, there is often an outdated public image of mining, which makes it difficult for the industry to communicate what it is like to work in a modern, high-tech mine.

The strategies propose various information initiatives to increase interest in managing the supply of skills to the mining industry. Australia's strategy discusses how the country will attract international labour. The US's strategy points to the need to develop higher-education programmes that attract people with academic skills in the natural and social sciences and in humanities to courses that focus on various aspects of the metals and minerals value chains.

## Sustainability

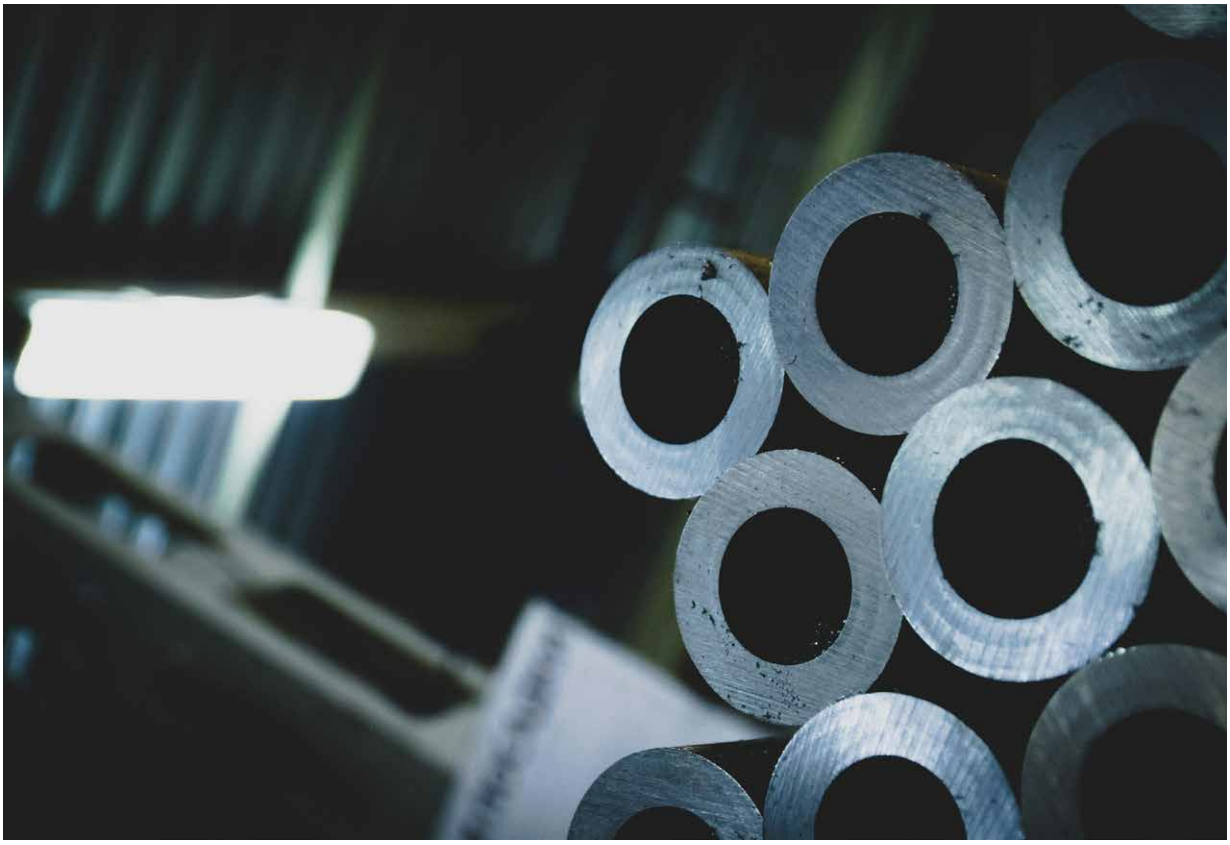
A broad sustainability perspective, including environmental, economic and social aspects, is prominent in both the Australian and Canadian strategies. Australia identifies this as a key area and wants to make the quality of its sustainability performance an essential factor in both marketing its products and in attracting international investment.

Relations with First Nations are also prominent in Australian and Canadian strategies. The starting point is humble; historically, the issue has not been addressed satisfactorily in either country, a situation that the strategies seek to change. These countries' strategies emphasise that indigenous peoples' interests and involvement are central to future initiatives, and that these must be implemented so as to provide real economic benefits to First Nation peoples through jobs and social development.

Social sustainability plays a significant role in Norway's strategy. That applies particularly to the relationship with the Sami, based on the UN Declaration on Indigenous Peoples. It proposes measures for consultation procedures, early dialogue, rules for exploration permits, and the impact of mining on reindeer husbandry.

## International trade relations

The strategies we discuss here all aim to secure a country's supply of metals and minerals. The starting points differ. The challenge for Australia and Canada is to extract their resources and to be a reliable and long-term international trading partner. The challenge for the United States is to break its heavy dependence on imports from China in both the short and long terms. Since it can only rely on imports, South Korea needs to strike a balance between the countries selling



metals and minerals, and managing the trade tensions resulting from geopolitical developments.

All countries want to build long-term trade relationships with selected countries or unions, such as the EU. The overall criteria for selection are that the intended partners are market economies and democracies. At the same time, policies and measures should address the fact that countries depend on a single major exporter, in most cases China.

Australia, Canada and the United States have concluded agreements with several countries and the EU, and also aim to take leading roles in international cooperation organisations. And, as noted above, the United States is looking to secure commodity supplies through its international Mineral Security Partnership.

The African Union is also working on a strategy for metals and minerals. Preparatory work for this states that that the EU and many countries outside Africa have strategies aimed at securing their supply and controlling as many links as possible in the value chains (African Development Bank Group, 2022). That makes it difficult for African countries to benefit fully from their large raw-material resources. The preparatory work for the strategy discusses most of the areas and types of measures presented in this chapter. It also notes that the primary interest of producers from Asia and the West is to secure their full access to unprocessed raw materials, and not to contribute to the development of the mining industry in African countries.

## Strategy work in Sweden and Finland

Finnish and Swedish strategy work is done in the context of the EU's CRMA. While this Regulation obliges Member States to implement specific measures, it can also be seen as a framework for national strategies (see Chapter 3). The CRMA includes provisions for investment in strategic projects. At the same time, the authorisation processes for these projects in each Member State must meet set requirements for time and forms of contact with the authorities. The CRMA also sets targets for the supply of critical metals and minerals, for circular flows, and for recycling.

Sweden's and Finland's mineral strategies are relatively old, Sweden's from 2013 and Finland's from 2010 (Ministry of Enterprise and Innovation, 2013; Ministry of Employment and the Economy, 2010). In its 2024 budget bill, the Swedish Government announced a new mineral strategy, with the Ministry of Climate and Business Affairs starting work on it in March the same year. In Finland, the corresponding work began at the end of 2023 with the intention of completing it by the end of 2024. The IVA project's three background reports describe the conditions and challenges pertaining specifically to Sweden. In the following paragraphs, we compare some aspects of Finland's and Sweden's strategy work.

Both countries have vibrant mining sectors that are run and supported by high-tech companies. Many foreign mining companies are active in both Sweden and Finland, playing a significant role in exploration. Using international exploration project data, Sweden remained in 27th place in 2022 in terms of the number of active projects in the country, while Finland was placed 22nd, continuing an upward trend that started in 2019 (Geological Survey of Sweden [SGU], 2022a). In Finland, the wholly state-owned Finnish Metal Group plays an essential role in many ventures in the mining and battery sectors.

Finland's strategy work, which has progressed further and is to be completed earlier than Sweden's, includes questions about the national need for metals and minerals. That means an approach that consists of an analysis of the development of the country's industry, the effects of technological development, and the consequences of the need for metals and minerals.

Both countries' strategy work raises issues relating to research and development and the supply of skills. In Finland, there is discussion of a feared future shortage of researchers with specialist skills, as it is already challenging to attract students to courses in the field. The lack of access to skills also means that it may be difficult to fill positions in academia and industry, and with the authorities where specialist knowledge is required.

In Sweden, an inquiry has proposed measures for modernising the Minerals Act ('*En tryggad försörjning av metaller och mineral*', SOU 2022:56). Finland reformed its Mining Act extensively in 2011, with further revisions since then, most recently in 2023. Other legislation affecting mining and exploration has also been revised in recent years. For example, a new mining tax has been introduced, with 60% of the revenue going to municipalities hosting mining operations. These municipalities also have a de facto right of veto over establishing new mines through their land-use decision-making powers. Compensation to landowners for exploration is also more generous than is the case in Sweden.

The discussion on licensing processes and the social acceptance of mining activities in the two countries is very similar, as is how the rights of indigenous peoples are to be safeguarded. A broad sustainability perspective is a starting point for both countries' work.

The starting point for Norway's recently published strategy is the combined Nordic resources of critical metals and minerals (Ministry of Trade, Industry and Fisheries, 2023). Nordic cooperation is an open question in Swedish and Finnish strategy work. Initiatives have been taken within the Nordic Council's Nordic Innovation programme framework to develop a picture of the overall regional supply of critical metals and minerals. The study was carried out by the SGU and its counterparts in other Nordic countries (Eliu et al, 2021). Together with the Nordic Group for Circular Economy (NCE), Nordic Innovation has published a report on the opportunities for circular flows of critical metals and minerals in the region, with the starting point being the CRMA's requirements and ambitions (Bergfald et al, 2024).

# 5. The EU's Critical Raw Materials Act

»The EU wants to secure the supply of critical metals and minerals through imports. Within Europe, extraction, refining and recycling will increase.«

The EU's work on the supply of critical raw materials began in the early 2000s as concerns grew about the supply of essential raw materials to European industry. In February 2023, the EU launched the Green Deal Industrial Plan for the path to a climate-neutral EU in 2050. The Net Zero Industry Act and the Critical Raw Materials Act (CRMA) were launched to provide a strong structure for the plan. Adopted in March 2024, the CRMA is part of the scheme designed to develop the internal market and strengthen the Union's competitiveness (Hool et al, 2023).

The CRMA aims to secure Member States' access to critical raw materials. The list of selected raw materials is dominated by metals and minerals that are important for the technologies central to the transition to a fossil-free, sustainable society and other vital societal interests such as defence. The CRMA is an agreement between the countries of the Union and takes the form of a Regulation. That means that its content must be directly applied in each Member State, unlike a Directive, where the countries themselves are responsible for the forms of implementation.[2]

The CRMA consists of detailed legal text and commentary, which sets out the content, processes and methods for implementing its provisions. At the same time, it considers which issues lie at the Union level and which are national responsibilities. The impact of the CRMA will thus depend on how effectively and efficiently it is implemented in different countries. The EU's way of monitoring and driving the work forward is to use several evaluation criteria that apply at the EU level, but not nationally. One of the reasons for this is that the Member States have very different conditions in terms of access to metals and minerals.

The description of the CRMA below shows that it includes many of the areas described in Chapter 4. However, there are also differences, such as less emphasis on education and skills supply, which are explained by the fact that the CRMA is based on which issues are common to the EU and which are national.

## Purpose and objectives

The CRMA identifies 34 critical raw materials, of which the majority are metals and minerals (see Table 1). These meet two criteria. One is that they are crucial for European industry. The second is the geopolitical risk that Europe's supply could be restricted by the actions of one or a few dominant exporters. The list of critical raw materials will be updated every three years.

Strategic raw materials are essential for the green transition, for digitalisation, and for defence. The ambition is to increase their availability through domestic mine production and by developing value chains within Europe. Projects that target these strategic raw materials have as short a timescale as possible for authorisation. All strategic raw materials on the CRMA list are also classified as being critical.

In practice, it is difficult to draw the distinction between critical and strategic raw materials. In presentations by the European Commission, critical raw materials are often presented as a ring surrounding those that are considered to be strategic.

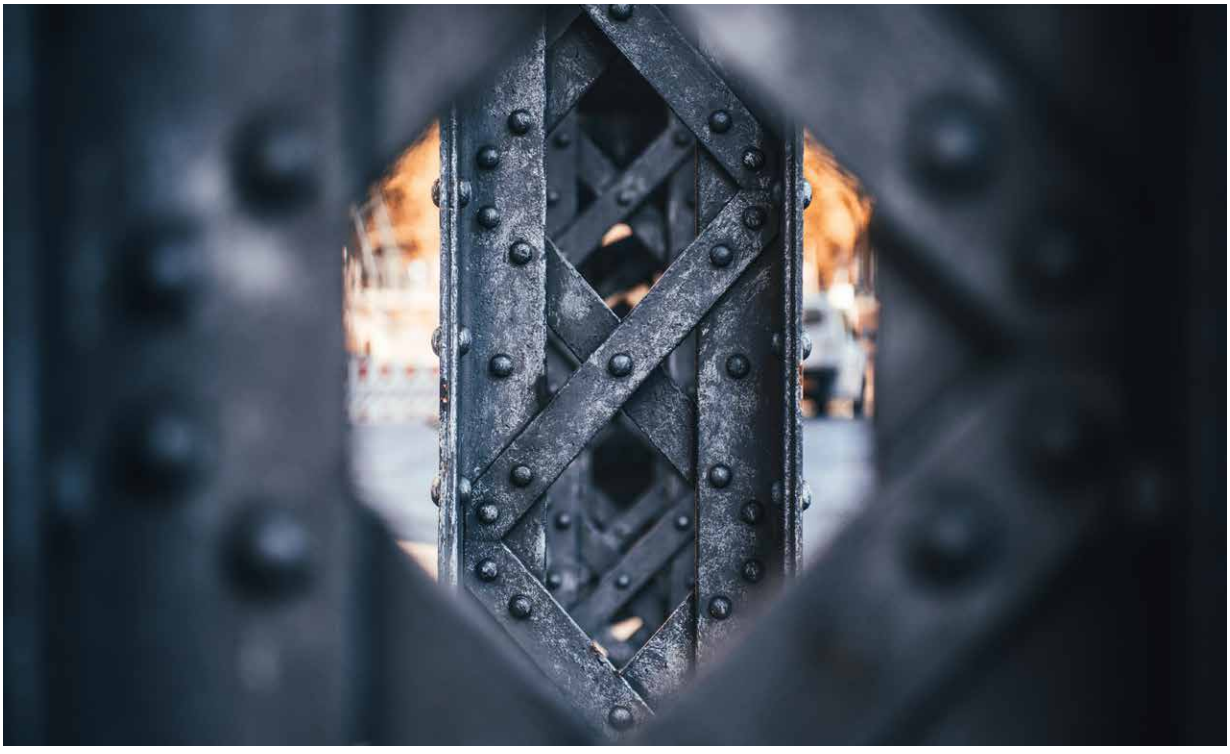
The CRMA aims to secure access to critical raw materials in two ways:

- Importing critical raw materials from the international market; *and*
- The production, processing and recycling of critical raw materials within the Union.

2 For an overview of the CRMA, see e.g., Consilium, 2024.

**Table 1:** The left column lists raw materials classified as critical by the EU in 2023. The middle column shows those classified as strategic, which have an even higher priority. The right column represents the proportion of the total amount of a material used in EU production that comes from the recycling of post-consumer scrap (EOL-RIR).

| **Critical Raw Materials in the EU 2023** (European Parliament, 2023, Annex II) | **Strategic Raw Materials in the EU 2023** (European Parliament, 2023, Annex I) | **EOL-RIR (End-of-life recycling input rate)** (Grohol & Veeh, 2023, Annex 11) |
|---|---|---|
| Antimony | | 28% |
| Arsenic | | 0% |
| Baryte | | 0% |
| Bauxite/Alumina/Aluminium | Bauxite/Alumina/Aluminium | 32% |
| Beryllium | | 0% |
| Bismuth | Bismuth | 0% |
| Boron | Boron (metallurgical grade) | 1% |
| Cobalt | Cobalt | 22% |
| Coking Coal | | 0% |
| Copper | Copper | 55% |
| Feldspar | | 1% |
| Fluorspar | | 1% |
| Gallium | Gallium | 0% |
| Germanium | Germanium | 2% |
| Graphite | Graphite (battery grade) | 3% |
| Hafnium | | 0% |
| Heavy and light Rare-earth elements | Rare-earth elements for permanent magnets (Nd, Pr, Tb, Dy, Gd, Sm and Ce) | 1% |
| Helium | | 2% |
| Lithium | Lithium (battery grade) | 0% |
| Magnesium | Magnesium metal | 13% |
| Manganese | Manganese (battery grade) | 9% |
| Nickel (battery grade) | Nickel (battery grade) | 16% |
| Niobium | | 0% |
| Phosphate rock | | 0% |
| Phosphorus | | 0% |
| Platinum Group Metals (PGM) | Platinum Group Metals (PGM) | 12% |
| Scandium | | 0% |
| Silicon metal | Silicon metal | 0% |
| Strontium | | 0% |
| Tantalum | | 1% |
| Titanium metal | Titanium metal | 1% |
| Tungsten | Tungsten | 42% |
| Vanadium | | 6% |



Production and processing must meet different criteria, including sustainability, whether imported or produced within the Union.

For the strategic raw materials consumed in the EU, the target for 2030 is that:

- 10% is to be produced and 40% is to be processed within the Union;
- 25% will come from materials recycled within the EU; *and*
- Dependence on a single exporting country should not exceed 65% for a single critical metal or mineral.

Member States will step up their efforts to extract strategic metals and minerals within Europe to reach these targets. They will also increase efforts to achieve the targets for circularity.

The EU will continuously map the availability of critical and strategic metals and minerals with different industries' current and future needs. To this end, each Member State must report on the supply in its country, the aim being to create an overall picture of supply and demand in the EU. Company boards must monitor these issues, but the Regulation does not require them to report to national authorities. The argument for this arrangement is that it concerns trade secrets. As a result, the overall EU picture will depend on the quality of the information that is collected by individual countries at a national level.

## Research, development and innovation

Member States are required to invest in geological mapping to improve knowledge of the potential for producing critical

metals and minerals. This includes creating better conditions for investment in exploration, which is a high business-risk activity. Projects aimed at developing value chains within the EU will also be stimulated. In addition, Member States will make efforts to develop technologies, resource-efficient practices, and circular business models to reduce the rate of increase in the use of critical metals and minerals.

## Strategic projects

Strategic projects are those deemed particularly important for achieving the objectives of the CRMA. As described above, they are intended to focus primarily on strategic metals and minerals. Strategic projects may also involve countries outside Europe, and must meet various sustainability criteria.

Strategic projects will be prioritised in national permitting processes where the initial process should not take more than 27 months. Member States must also identify a single point of contact with the authorities involved in the permitting processes.

Projects can receive financial support at the EU level from different funds, one example being the European Regional and Innovation Funds. Some Member States, such as Italy and Germany, have already set up national funds for strategic projects.

A special committee that includes representatives from all Member States will assess which projects are to be classified as strategic. Various groups will work under this board to facilitate the exchange of knowledge and experience on the projects. Their focus will include, for example, financing, geological mapping, social acceptance and circularity.

## Skills supply

Considered to be national issues in the EU, education and skills development have been given less prominence in the CRMA, although a partnership programme will be developed to develop skills in CRMA areas. A Raw Materials Academy will develop skills relevant to the workforce in different parts of the value chains. This will be done within the framework of the European Institute of Innovation and Technology, supported by the EU.

Partner countries outside the Union will benefit from the work on skills development through the Global Gateway, the EU's global strategy to stimulate investment in infrastructure.

## Sustainability and the interests of indigenous peoples

The sustainability perspective permeates the entire CRMA, from the requirements for extracting critical metals and minerals and the requirements for circularity, to managing the interests of local populations and indigenous peoples.

For this reason, strategic project applications should include analyses of their impacts on these groups. They must also include a plan for constructive consultation with them, and how they will be financially compensated. This also applies to projects involving non-EU countries.

## International trade relations

The EU recognises that it can never be self-sufficient in critical metals and minerals, and as a net importer will depend on a functioning world trade system. The CRMA underlines the importance of strengthening the World Trade Organization (WTO) and of concluding more agreements to facilitate sustainable investment (through the EU's Sustainable Investment Facilitation Agreement) and free-trade agreements.

Work on shaping strategic partnerships will be intensified. A selection of countries will be given the status of strategic partners to the EU, prioritising different types of cooperation. These countries will be part of a Critical Raw Materials Club of countries with similar views on trade and sustainability.

# 6. A Swedish policy for the supply of critical metals and minerals – the starting points

»The CRMA provides a framework for Sweden's work on the supply of metals and minerals.«

As described in Chapter 5, the CRMA provides a framework for Sweden's work on the supply of metals and minerals. It:

- Sets out the level of ambition and requirements for extraction and circularity to meet the needs for critical metals and minerals;
- Emphasises the need to increase knowledge about the availability of critical metals and minerals – that is, geological research;
- Provides opportunities for companies and the country to benefit from investments in strategic projects;
- Requires Sweden to complete initial permit reviews for these strategic projects within 27 months;
- Specifies what should apply to indigenous peoples and other groups affected by, for example, new mining developments;
- Implies an obligation to report on strategic metals and minerals supply;
- Identifies some countries that should be prioritised in the critical metals and minerals trade; *and*
- Implies a need to create national competence and monitoring of what the CRMA means for Sweden (in terms of both compliance and opportunities), how we can influence the work on the process of managing the EU's supply of strategic metals and minerals, and how we coordinate our work towards the EU in this area.

The CRMA thus provides the starting points for a strategy for the supply of metals and minerals. However, as the international examples outlined in Chapter 4 show, measures are also required in other areas in order to create a comprehensive policy. Using these as a guide, what essential questions should a Swedish strategy for the supply of metals and minerals answer? Here are some examples:

- What international role should Sweden play in the supply of critical metals and minerals?
- How should we capitalise on our strengths as a mining cluster? How should we address Sweden's weaknesses?
- What investments in research and innovation should be prioritised?
- How should Sweden best take advantage of the opportunities the EU's strategic projects offer? Which international partnerships should be pursued?
- How should Sweden best influence the EU's CRMA work on harmonised EU legislation?
- What efforts should Sweden make to increase the focus on resource efficiency and the circular elements in the supply of critical metals and minerals?
- What investments are needed to manage the supply of skills?
- How does the EU's trade policy, including factors such as prioritised countries, affect Sweden's export industry with business worldwide? *and*
- How should we develop permitting processes to facilitate investment and increase the democratic legitimacy of extracting critical metals and minerals in Sweden? How should conflicts of objectives and interests best be managed?

The project's final report, *'Metals and Minerals for Sustainable Development and Strengthened Competitiveness'*, will present several concrete proposals that are considered to be essential to a Swedish strategy. These are based on the work in the project's reports on extraction (IVA, 2024a) and circularity (IVA, 2024b), as well as this report.

In the following chapters, we will address the last question in the list above – how should permitting processes in Sweden be developed and changed? How should the issues surrounding the democratic legitimacy of projects for supplying metals and minerals be tackled? And how should the related conflicts of objectives and interests be managed?

# 7. Permitting processes – a controversial democratic institution

»Environmental assessments can be seen as one of our democracy's ways of dealing with difficult and complex conflicts of interest and objectives transparently and predictably.«

The use of metals and minerals is increasing as a result of the transition to a fossil-free and sustainable society. This is true both for those commodities that have already been in demand in large volumes, and to many of those classified as critical and strategic by the EU (see Chapter 5). Extraction and increased investment in resource efficiency and circularity will be required in order to meet the increased demand. The level of demand for various critical metals and minerals will be determined by future consumption patterns and by substitution opportunities that are made possible by technological developments (IVA, 2024a; IVA, 2024b).

Through the Critical Raw Materials Act (CRMA), the EU has laid the foundation for a European strategy for the increased production of metals and minerals (see Chapter 5). As a leading European mining nation, Sweden will have a central role in achieving this through access to metals and minerals, and because of its endowment of world-leading mining-sector companies (IVA, 2024a).

A number of permits are needed when new mines are opened or existing ones are expanded. The Environmental Code is central to meeting the requirements of an environmental assessment. Opening a new mine also requires assessments under the Minerals Act and the Planning and Building Act (see Figure 1).

Criticism has been voiced within both the business and political communities about the content and implementation of environmental assessments, which are considered to be both unpredictable and time-consuming. According to the critics, this prevents investment and makes the rational management of major investments more difficult (Skår, 2022). The application of EU legislation on nature conservation and water management has also been criticised (IVA, 2021; Skår, 2022). Even government representatives have been critical: in an interview in March 2024, Minister for the Environment Romina Pourmokhtari expressed the view that our permitting processes are complicating our efforts to achieve emission targets (Sveriges Television, 2024), while Minister for Enterprise and Innovation Ebba Busch has claimed that permitting takes too long.

Sweden is not alone in having a debate on environmental assessments. In Australia, Canada and Finland, for example, critics also say that they take a long time, coordination between different authorities is poor, and there is a lack of competence among the officers at the authorities involved (Söderholm et al, 2016).

From a societal perspective, an environmental assessment is part of an important institution. As part of legislation and law enforcement, it contributes to building the foundation for one of several institutions that are prerequisites for a functioning democracy and market economy (North, 1990). From this perspective, environmental assessments can be seen as one of our democracy's ways of dealing with difficult and complex conflicts of interest and objectives transparently and predictably.

The basis for environmental assessments is a legal framework, the Environmental Code (SFS 1998:808). The part that regulates environmental assessments is designed primar-

**CONFLICTS OF INTERESTS AND OBJECTIVES**

**Conflicts of interest** arise between stakeholders, i.e. groups such as traders, local interest groups and landowners. Such conflicts may be over land use, for example, or the establishment of wind turbines or industrial facilities. Such conflicts can often be managed using legal instruments such as expropriation and compensation levels..

**Conflicts of objectives** are conflicts between different types of overall objectives. One example is the conflict between climate change mitigation and biodiversity enhancement; another is the conflict between different interests over the conservation of a natural environment or the extraction of a natural resource in the area.

ily to protect the local environment from excessive burdens when establishing environmentally hazardous activities. In some cases, however, decisions on conditions may limit the overall environmental benefit. The Environmental Code provides some scope for making trade-offs and for dealing with this problem (see the section *Opportunities to Integrate the Sustainability Perspective in Current Environmental Assessments*). Managing local environmental impacts in a legally secure and predictable way while concurrently considering global impacts is a challenge in the transition to a fossil-free, sustainable society.

Environmental assessments have been examined from different perspectives over a number of years. Several proposals have been put forward by organisations such as Svemin (2021), the Swedish Society for Nature Conservation (2023) and Fossil-free Sweden (2023).

The issues have also been addressed in two government inquiries, *'Om prövning och omprövning – en del av den gröna omställningen'* (SOU 2022:33) and *'En tryggad försörjning av metaller och mineral'* (SOU 2022:56). They are therefore of great relevance to the issues that we discuss here and, together with other research reviews, form an important basis for this report.

**There needs to be a factual and constructive discussion on permitting processes for activities with an environmental impact as part of the work on the transition to a sustainable society. The issues are complex. How they are handled affects society, the environment, and the living conditions of many people. For this reason it is essential to:**

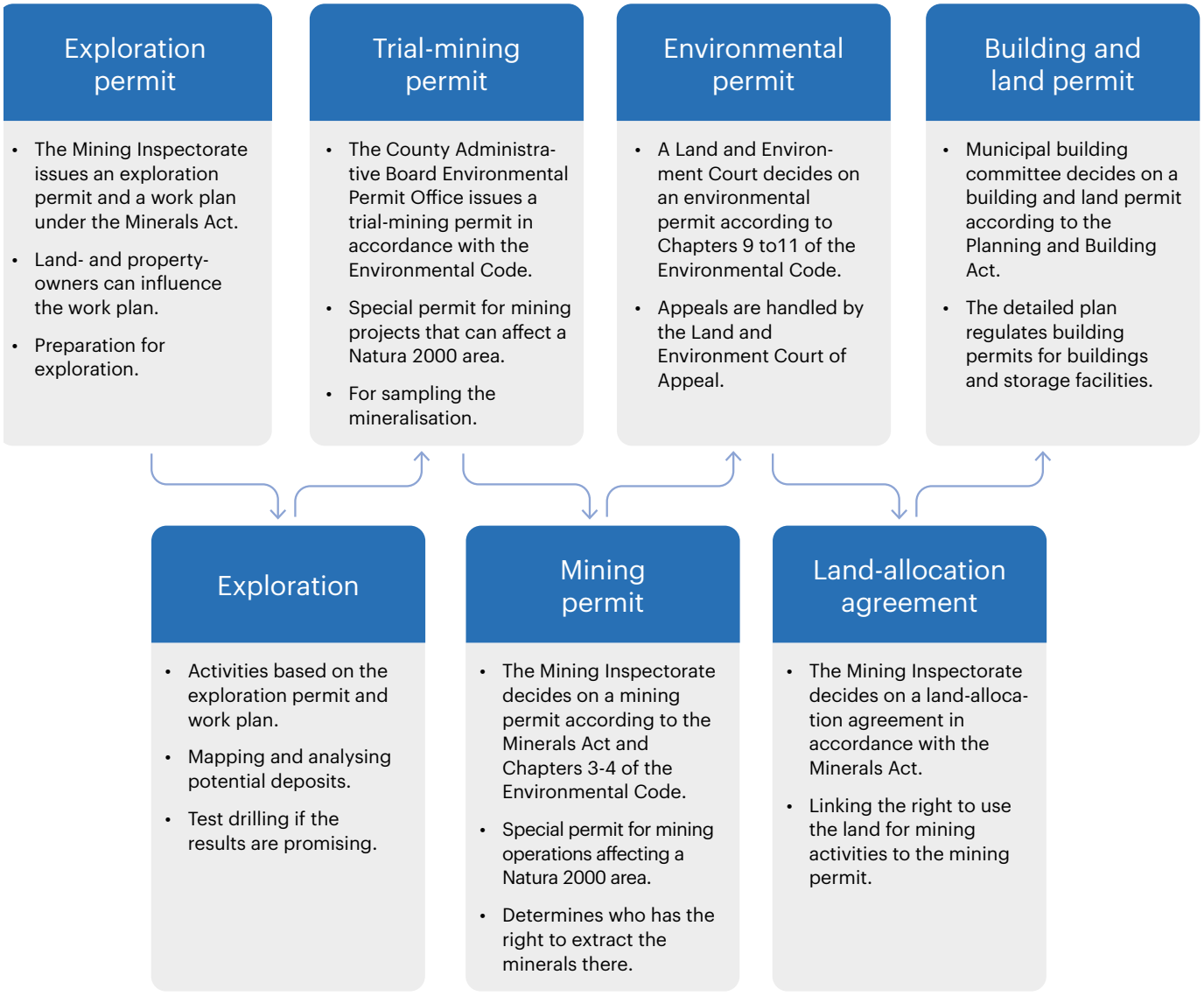
- **Move from sweeping, categorical criticism to making suggestions for improvement while respecting the strengths and limitations of environmental and other permitting processes*; and***
- **Highlight the conflicting objectives that cannot be resolved within the framework of environmental assessments and which must, therefore, be dealt with by policy. The issues are often difficult. A range of intra- and inter-generational, national and regional interests must be balanced. The solutions required must have an impact over many terms of office. There is every reason to approach these fundamentally difficult policy issues and those who will make the decisions with respect.**

## Permitting processes

Figure 1 shows the different steps in the permitting process, from exploration to mining. Authority is exercised by:

- **The Mining Inspectorate of Sweden** (*Bergsstaten* – a decision-making body under the Swedish Geological Survey, SGU). It is tasked with handling matters relating to the exploration and production of minerals. Decisions are made in line with the Minerals Act (SFS 1991:45).

## FIGURE 1: THE PERMITTING PROCESS FOR MINES




### Renewed authorisations

As mining operations continue, permits are constantly being renewed, with the process restarting at different stages depending on the changes to be made to the operations.

- **Environmental assessment panels**, which have an independent function within each county's administrative board, and make decisions concerning permits for environmentally hazardous activities and for changes to permits and conditions.

- **The Land and Environment Courts**, whose main task is to handle cases under the Environmental Code (SFS 1998:808), the Property Formation Act (SFS 1970:988), and the Planning and Building Act (SFS 2010:900). There are five Land and Environmental Courts in Sweden.

- **Municipal building committees**, which handle a municipality's activities under the Planning and Building Act. These boards, which may have names such as Miljö- och byggnadsnämnden or Samhällsbyggnadsnämnden, are made up of elected representatives at the municipal level.

Sweden differs from the majority of EU Member States in that it examines applications for environmental permits for so-called A activities, such as mining and water activities, as part of the first stage of the process. This involves a legal procedure similar to that in a court of law. In other Member States, this step takes place in an administrative review.

## Environmental assessments – changing over time

The political and legal basis for environmental assessments changes over time. Societal developments and the debate around different policy areas influence these. In Figure 2, we provide an overview of this interaction.

The clouds at the top of the figure describe different issues that have influenced policy. Climate change and biodiversity issues have received increasing attention in recent decades. This has resulted in various initiatives for sustainable development, renewable energy, green industry, and circularity. At the same time, changes in values, increased demands for legitimacy, and the participation of new groups have brought more stakeholders into the processes. This has changed the conditions, the content and the scope of the issues that environmental assessments must address (Söderholm et al, 2022).

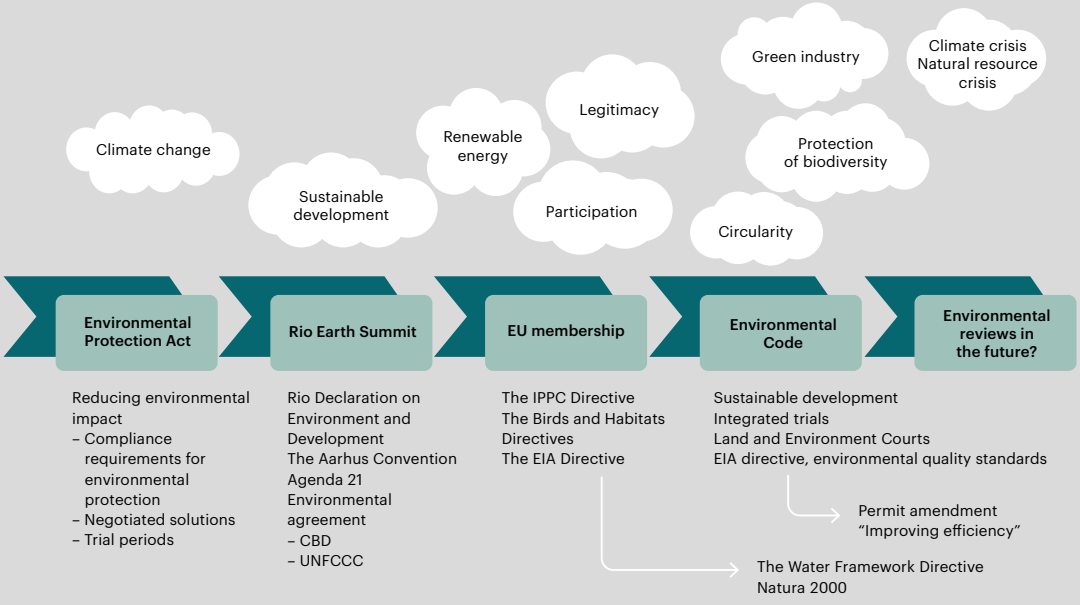
The content of the rectangles in the image describes steps in the development of today's environmental legislation, of which environmental assessments are a part. They should be seen in the light of the issues that have been the focus of public debate, exemplified in the clouds at the top of the figure. However, these should not be seen as being directly related to each stage.

**The first stage** is the Swedish Environmental Protection Act, applied between 1969 and 1998. In this system, the law was used by the Concessions Board for Environmental Protection, a predecessor of the Land and Environment Courts. During this period, environmental assessments were primarily based on consensus-orientated, recurring dialogues between operators and the authorities. These were negotiations between a relatively small and exclusive group of experts, where both parties had considerable expertise. In other words, the system had a corporatist element (Söderholm et al, 2022).

**The second step** was the UN Rio Conference in 1992, which resulted in a series of international conventions. The Climate Convention contained elaborate obligations for the signatory countries to limit greenhouse-gas emissions. It also set out how further work in this area should be undertaken, not least in the form of national legislation. A decision was also made on a financial mechanism. Important international agreements such as the Aarhus Convention on access to information on environmental matters, public participation in environmental decision-making, and access to justice on environmental issues came into being after this, and the Rio Conference also had a major influence on subsequent EU legislation.

**The third step** was Sweden's EU membership in 1995, which entailed a commitment to make parts of EU legislation into national law. This has affected environmental assessments through, for example, the Birds and Habitats Di-

**Figure 2:** Environmental assessments over time




rectives, the EIA Directive,[3] the Water Framework Directive, requirements for periodic reviews of industrial permits, and for updates to existing permit conditions.

The consequences of applying EU legislation for environmental assessments in Sweden are the subject of critical debate. In its Sustainable Water Supply project, the IVA called for a review of how the Water Framework Directive is applied (IVA, 2021). Svemin has expressed concern about how the Industrial Emissions Directive is applied and how the Nature Restoration Act, issued in August 2024, may be applied (Matthis, 2023). In this context, the question has also been raised as to whether Sweden is 'over-implementing' EU legislation (IVA, 2021).

At the same time, representatives of environmental and climate organisations have expressed concerns that, despite its high ambitions, the legislation is insufficient to prevent biodiversity loss and the depletion of ecosystems. In Sweden, this applies particularly to issues relating to the agricultural sector.

**The fourth step**, in 1999, was the consolidation of Swedish environmental legislation into a single framework law, the Environmental Code (SFS 1998:808). The change meant that more categories of stakeholders were counted as such, and were given the right to speak in environmental assessments. A number of environmental organisations were also allowed to appeal against decisions to the Land and Environment Court of Appeal. These changes effectively brought greater imbalance between the different stake-

3 EIA = Environmental Impact Assessment

holders in terms of expertise and resources for bringing their case, compared with the application of the Environmental Protection Act in 1969–1988, when processes involved fewer parties with equivalent expertise.

The discussion on environmental assessments also highlights that the authorities' role has changed somewhat. Administrators have increasingly taken on the role of a party that must prioritise the implementation of specific legislation, which has meant less consideration from a holistic perspective, with the role of experts who have the task of guiding the relevant court in a decision having been toned down. This has led to a shift in the expertise of officials from factual knowledge to more formal legality, a change that has occurred in part because of the way in which EU directives have been translated into national legislation and regulations (such as the Water Framework Directive), which have binding environmental quality standards.

**To have a constructive discussion on environmental assessments, it is essential to distinguish between two perspectives:**

- **Legislation. Environmental assessment is regulated by the Environmental Code, whose provisions are partly based on political decisions. These in turn are based on political values and priorities. Fundamental critical debate on how these political decisions have influenced legislation must, therefore, take place in political processes at both the national and EU levels.**
- **Effectiveness. How legislation is applied and how environmental assessment is carried out is a question of efficiency, effectiveness, and scope for improvement. In the following sections, we discuss criticisms and proposed solutions from this perspective.**

**Table 2:** The criticism of the implementation of environmental assessments – applicants' and authorities' perspectives. Source: SOU 2022:33.

| Operators' perspective | Relevant authorities' perspective |
|---|---|
| **Lack of process management**<br>The courts do not take an independent stance on the authorities' requests for supplementary information. The authorities are late with requests for supplementary information. The timetables for the processes are not met. | **Lack of process management**<br>Assessment authorities do not take an independent stance on what supplementary information is needed. These issues are then taken all the way to consideration by higher courts. Work schedules are not frequently used. |
| **Passive role of county councils in an unclear process**<br>They play too passive a role in the consultation process. Dialogue with applicants is often inadequate. | **Lack of resources**<br>Authorities with a role as a party have to prioritise which cases they are involved in and have specific prioritisation schemes for this.. |
| **Unclear investigation requirements and unclear environmental benefits**<br>There is a lack of guidance and support material for applicants. | **Incorrect delimitation of applications**<br>Only one of several activities subject to a permit is described in the application and the environmental impact assessment. Supplements are then required and these take time. |
| **Difficulties in changing an activity**<br>It is often unclear when to apply for a permit and when to apply for a change of activity. | |
| **Too many regulatory issues in assessments**<br>Issues that are ultimately delegated to the regulator still find their way into the assessment process. | |
| **Lack of 'promotion perspective'**<br>For example, there is a lack of balance between bodies that monitor environmental interests and other dimensions of sustainable development. | |

## Stakeholders' views on environmental assessments

During the preparation of the report *'On assessment and review – part of the green transition'* (SOU 2022:33), extensive discussions were held with the business community (referred to in the report as 'operators') and those working at the relevant authorities about their views on environmental assessments. The results showed both agreement and differing views (see Table 2).

There was broad agreement that there are shortcomings in how the processes are carried out. It is also possible to trace a relationship between the operators' criticism of what they perceive as passive action by the county administrative boards, and the authorities' own statement that there is a lack of resources.

There is also agreement that there are shortcomings in the assessment documentation. The explanations for these differ, however. The operators think the investigation requirements are unclear, while the authorities believe the applications are often incorrectly delimited.

The operators have three further areas in which they criticise the environmental assessments:

- The difficulty of changing an activity – in other words, the answer as to whether you have to apply for a new permit for what you perceive to be a change to an existing activity, or whether a change application is sufficient;
- Too many regulatory issues are raised unnecessarily in the licensing process, issues that ultimately end up with the regulators anyway; *and*
- An imbalance between the strict environmental aspects and other dimensions of sustainability.

In 2023, the county administrative boards presented a final report on their work on the role of the authority in these matters. As a result, the Government allocated SEK20 million to the County Administrative Board of Västerbotten to assist other county administrative boards in cutting processing times and creating a more predictable process (Nilén, 2024).

## Processing times

The lengthy processing times taken is a recurring issue in the Swedish debate on environmental assessments, with discouraging examples of decades being cited. The issue has also been raised by, for instance, Svemin, the Confederation of Swedish Enterprise, and the Swedish Society for Nature Conservation (Sandahl & Alarik, 2023; Skår, 2023). In addition, Sweden is not alone in this debate; the time it takes to obtain permits is discussed in most countries with developed mining industries (Söderholm et al, 2016).

The ministry memorandum *'Adapted environmental assessment for a green transition'* (Ds 2018:38) sets a benchmark of one year from the application being submitted to an initial decision. Neither the review bodies nor the operators had objections to this benchmark in their consultation responses.

Since 2020, the Swedish Environmental Protection Agency (EPA) has been compiling statistics on processing times on behalf of the Government (Swedish EPA, 2023). These are detailed and can provide answers to several questions:

- How long are the processing times in the first instance?
- How many cases are appealed, and how long does this process take?
- Who is appealing?
- What estimates can be made of the total processing times for appealed cases (from when an application is first considered to a decision being reached at a higher level')?

### Initial-application processing times for environmental assessments

Depending upon the type of permit sought, applicants have to follow one of two routes. Located at the county administrative boards, environmental assessment panels grant permits and amendments to licences for environmentally hazardous activities. Appeals against their decisions can be heard at the Land and Environment Courts, which themselves adjudicate initial applications covering environmental, real estate, water and sewage, and planning and con-

**Figure 3:** Average processing times for cases examined by the environmental assessment panels, in number of days. Total number of cases in 2020: 247, 2021: 236, 2022: 238. Source: Naturvårdsverket, 2023.

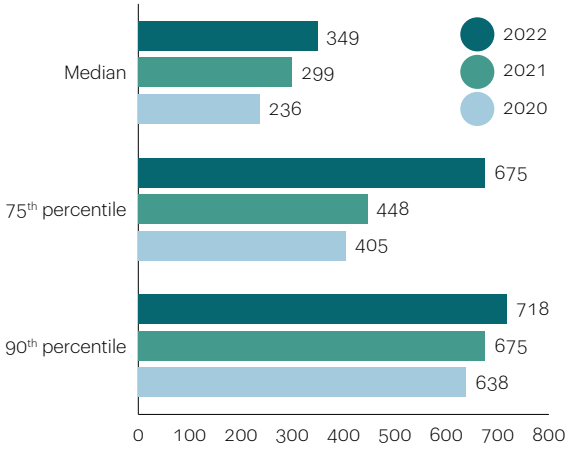
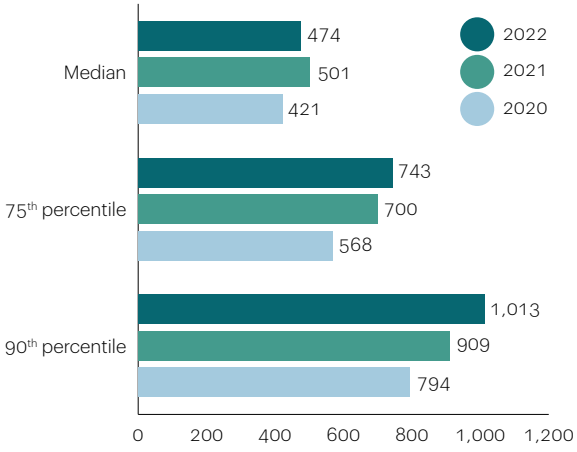



**Figure 4:** Average processing times for permit cases for environmentally hazardous activities reviewed by the Land and Environment Court, in number of days. Total number of cases in years 2020: 43, 2021: 44, 2022: 52. Source: Naturvårdsverket, 2023.




struction permits. Appeals against their decisions are heard in turn by the Land and Environment Court of Appeal.

The statistics are presented in median values and the 75th and 90th percentiles. The measure for the cases that take the longest time shows that it takes a specific maximum for 90% of them. Data on the remaining 10% are therefore missing from the compilation.

The review of processing times in the first instance in 2020–2022 shows that:

- For half of all cases in the environmental assessment panels, the time was one year or less. The corresponding time in the Land and Environment Courts was at least 14 months, and for 90% of the cases, at most 17 months.
- The statistics also include the cases that took the longest, as measured by the 90th percentile. In the environmental assessment panels, these cases took just under two years (between 21 and 23 months); in the Land and Environmental Courts, they took longer – 26 to 33 months.
- Around 80% of the cases dealt with in the first instance by either of the two bodies were granted permission as requested.

## Appeals

Appeals lodged during 2022 comprised:

- 20% of cases from the environmental assessment panels to the Land and Environment Court.
- 7% of cases from the Land and Environment Court to the Land and Environment Court of Appeal.

The Swedish EPA's statistics for the years 2021–2022 only cover the total times for cases that began in environmental assessment panels and were then appealed and decided in the Land and Environment Court. For cases that started in the Land and Environment Court and were decided in the Land and Environment Court of Appeal, statistics are available for 2020–2022. These statistics show that:

**Figure 5:** Average processing times for cases appealed from the environmental assessment panels, in number of days. Total number of cases in 2021: 56, 2022: 73. Source: Naturvårdsverket, 2023.

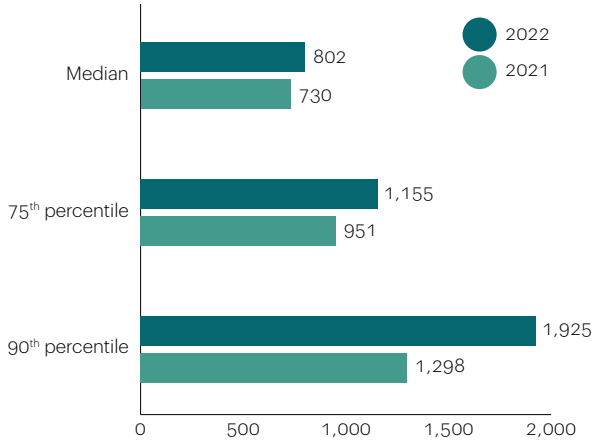



**Figure 6:** Average processing times for cases appealed from the Land and Environment Court, in in number of days. Total number of cases in 2020: 14, 2021: 22, 2022: 21. Source: Naturvårdsverket, 2023.

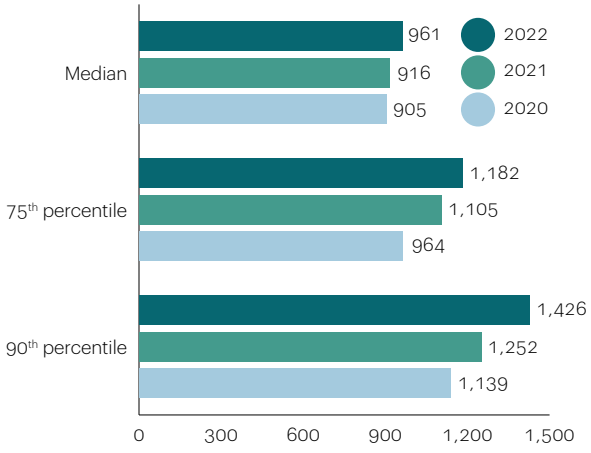



**Figure 7:** Appellant – environmental assessment panel – year 2022, number of cases. Source: Naturvårdsverket, 2023.

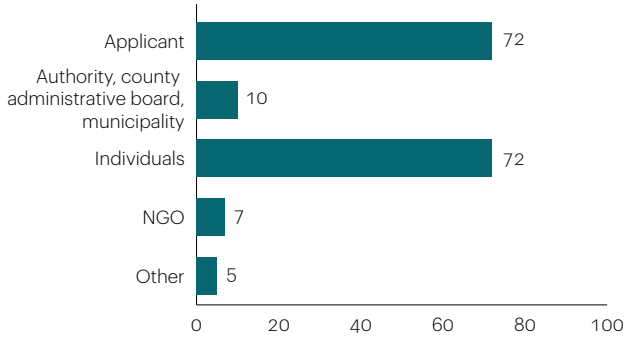
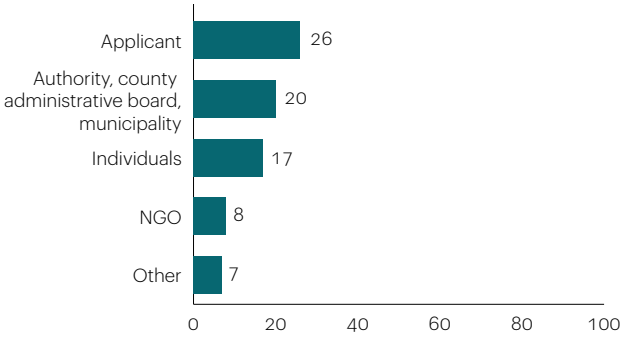



**Figure 8:** Appellant – Land and Environment Court – year 2022, number of cases. Source: Naturvårdsverket, 2023..




- For half of the cases from the environmental assessment panels, an initial review took at most between 24 and 27 months. For the cases that took the longest, as measured by the 90th percentile, processing times ranged from 43 to 64 months – nearly five and half years.

- For cases from the Land and Environment Court, the higher level review took from 30 to 32 months in most cases. For the cases that took the longest, the 90th percentile, processing times varied between 37 and 48 months.

The Swedish EPA's compilation of statistics on appeals also includes a report on the categories of actors who appeal. The results from calendar 2022 show that:

Two categories completely dominated appeals of the cases that were initiated in the environmental assessment panels and were appealed to the Land and Environment Court:

- The applicant. The appeal often concerns a condition of the decision; more rarely the whole; *and*
- Individuals, including property owners such as companies in forestry, agriculture and reindeer husbandry-

For issues that started in the Land and Environment Court and were appealed to the Land and Environment Court of Appeal, appeals were evenly divided between three categories:

- The applicant;
- Authorities, including county administrative boards or municipalities, who appealed to defend public interests; *and*
- Individuals, including property owners.

Non-profit organisations or others have the right to appeal, under Chapter 16, Section 13 of the Environmental Code. In this context, this usually means an organisation that works with nature conservation and environmental issues. These account for relatively few appeals in both categories:

- 4% in cases initiated in the environmental assessment panels; *and*
- 10% in cases initiated in the Land and Environment Court.

## Total processing times for environmental assessments – an estimate

It is not possible to estimate the total processing times from the first application to a decision at a higher level with any accuracy based on the Swedish EPA's statistics. It would be necessary to follow the processing times for each case in both instances, which cannot be done using the published data.

If the data for the first review and appeals are combined, they give an idea of the range of total processing times. That implicitly assumes that, for example, a case that takes a short time at the lower level will also take a short time at a higher level.

- For cases that start in the environmental assessment panels and are appealed, the median time is between 38 and 44 months. That gives us an indication of the overall time taken in the fastest cases. For the cases that take the longest, the 90$^{th}$ percentile, the total time is between 64 and 87 months.
- For cases that start in the Land and Environment Court and are appealed, the median time is between 44 and 49 months. For cases that take the longest, the 90$^{th}$ percentile, the total time is between 63 and 73 months.

## Processing times for metals and minerals activities – initial-application environmental assessments, exploration permits and processing concessions

Several categories of environmental issues were raised and examined in the cases used here as illustrations. Since the focus of this project is the supply of metals and minerals, cases in the ore and mineral category are of particular interest. Since there were actually very few of these, we discuss them separately in this section.

The Swedish EPA's statistics show the initial processing times for these cases in the Land and Environment Court. Four cases were decided in 2022. The processing times were longer than for the cases reported above, ranging from a little over 2 years to 5 years (28–60 months).

Two other licensing processes are also of interest for supplying metals and minerals – exploration licences and processing concessions. The Mining Inspectorate decides both of these, with statistics for 2020–2022 being provided in SGU's annual report (SGU, 2022b).

The total processing time for exploration permits was short; from 2020 to 2022, the time varied between 3.6 and 5 months, with between 77% and 90% of applications being granted. There were few applications for processing concessions: three each in 2020 and 2021, and four in 2022.

During the three years, one new concession decision was made, and the total processing time for new or expanded mines varied between 35 and 99 months.

The Mining Inspectorate's internal processing times are short. The SGU's annual report points out that a practice has developed whereby a Natura 2000 permit, where required, needs to be in place before a decision can be taken on a concession. Applicants often now prefer to apply for an environmental permit and a Natura 2000 permit in parallel with an exploitation concession as a means of reducing the processing time taken.

### Processing times – conclusions and reflections

- **In this report, we call for a debate that respectfully approaches the permitting processes as a key democratic institution for society's risk management. Our review of processing times shows that the system can handle about 80% of first-instance environmental assessments in relatively short periods.**
- **In our attempt to estimate the total processing times at the first and second levels, we end up at between three and just over seven years.**
- **Among those who appeal, applicants, property owners and authorities dominate. Environmental organisations account for only a small proportion of appeals.**
- **The statistics for the admittedly small number of cases in the mines and minerals category show longer times for environmental assessments in the first instance. In consequence, it takes a long time for decisions on exploitation concessions to be taken, as they are increasingly made in parallel.**
- **The debate on the efficiency of environmental assessments would be more constructive if it distinguished between the lengths of time taken for different applications. The cases that take the longest should be discussed regarding the system's efficiency in handling them, how the case's complexity affects the processing times, and how, from a societal risk-management perspective, we believe that such handling of complex cases should best be done. A factual and constructive discussion is particularly important for future cases involving extracting critical and strategic metals and minerals.**

## Improving environmental assessments

In *'Miljölagstiftningens betydelse för stora kunskapsintensiva investeringar'* (Pettersson & Söderholm, 2019) the authors summarised the conditions needed for an end-to-end environmental assessment:

- **Greater action and time flexibility.** 'Action flexibility' means in this context that an applicant company is allowed, for example, to choose a technical solution to reduce negative environmental impacts. 'Time flexibility' concerns the time that the company will have in order to comply with any conditions stipulated in the permit.
- **Predictability and transparency** are linked to the time required for environmental assessments, their implementation, and the content of the final conditions. It requires clear emission limits, an

**Table 3:** Problem areas in current environmental assessments. Source: SOU 2022:33.

| Problem areas | Description |
|---|---|
| **Change permits and applications** | It is too difficult to change an activity and too unclear where the line is drawn between permit and notification requirements. |
| **Reassessment of permits and conditions** | Reassessments are not carried out to a sufficient extent. There is a risk that old permits with significant environmental and climate impacts become permanent. |
| **Ineffective consultations** | Consultations are often characterised by unclear allocation of responsibilities and documentation. This leads to unnecessary and sometimes extensive supplementary requirements. |
| **Insufficient support for county administrative boards from central authorities** | Central support to the county administrative boards is often insufficient. There is also a lack of coordination of government interests at the national level. |
| **Passive process management** | Process management in the assessment authorities is often not active enough, which slows down the processes. |
| **Lack of expertise in new climate-friendly technologies among administrators at permitting authorities** | There is a lack of expertise among administrators at permitting authorities to assess the potential of new climate-friendly technologies in a permit case. |

efficient planning process, and sufficient review periods.

- **A good level of knowledge** within the authorities involved for the technical possibilities and economic consequences of different solutions to meet a permit requirement. A good level of expertise enables equal, consensual, but at the same time tough, negotiations between companies and regulators..

*'Om prövning och omprövning – en del av den gröna omställningen'* (SOU 2022:33) identified six problem areas associated with current environmental assessments (see Ta-

**PROPOSALS FROM THE INQUIRY *'OM PRÖVNING OCH OMPRÖVNING – EN DEL AV DEN GRÖNA OMSTÄLLNINGEN'* (SOU 2022:33)**

Published in 2022, the government-commissioned report *'Om prövning och omprövning – en del av den gröna omställningen'* (SOU 2022:33) contained a number of suggestions and recommendations that were aimed at:

**Introducing simpler rules for changes to activities**
Six proposals, including the introduction of a threshold for the notification of activities requiring a permit, and improved transparency for proposed changes to permits.

**Reassessment for modern environmental conditions**
Seven proposals, including a mandatory review of existing judgments and decisions, the introduction of wider grounds for reviewing permits and conditions, and making permits time-limited as a general rule.

**The role of the authorities in environmental assessments**
Five proposals, including improved coordination between the various permitting authorities involved, and between national interests and conflicting objectives.

**Process management and handling by the assessment authorities**
Eight proposals, including the introduction of statutory processing deadlines, making it easier to decide cases without a main hearing in the Land and Environment Courts, and promoting digital processing.

**Special support for climate projects**
Three proposals, including improved administrative support for the county administrative boards, and the establishment of a environmental technology knowledge centre at the Swedish Energy Agency.

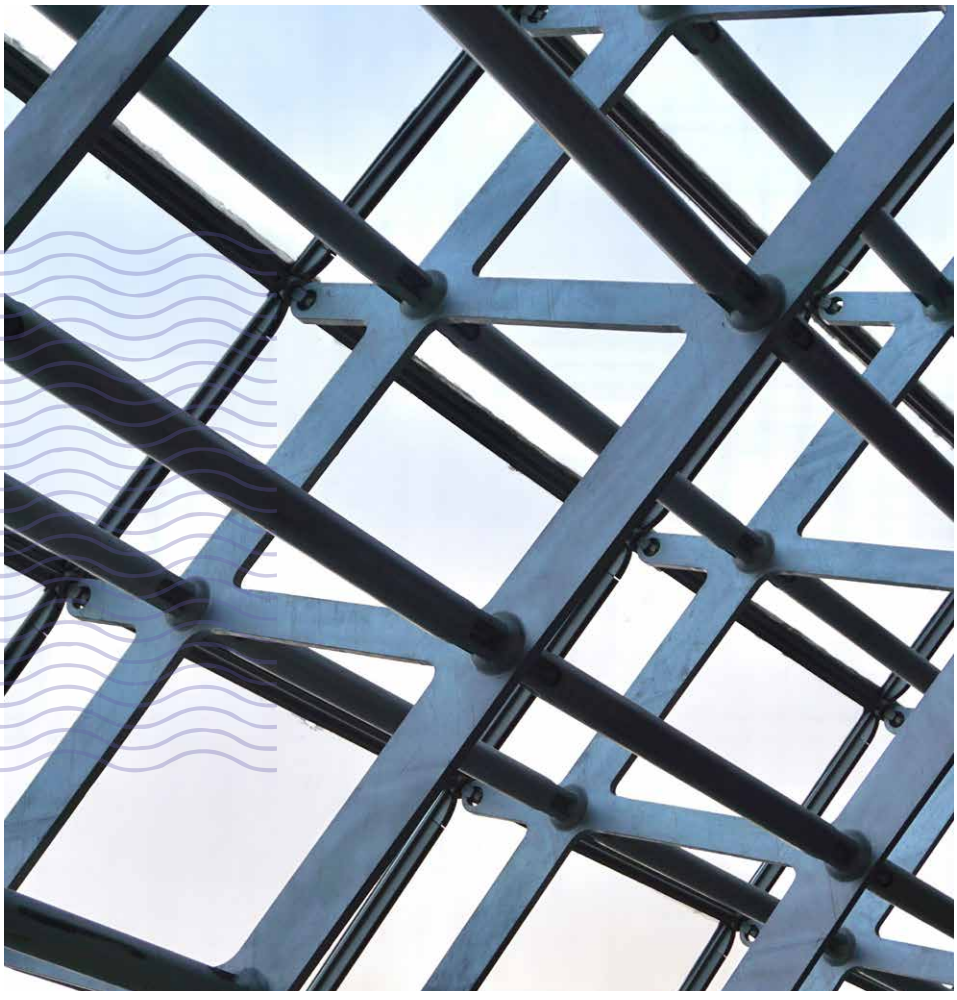
**Other proposals for a more efficient environmental assessment process**
Three proposals, including an investigation into how permit assessments can be made more efficient.

ble 3), and presented 32 concrete proposals that are aimed at addressing them. These are also grouped into six topics, as shown in the Info box.

In a debate article in *Dagens Industri* (Busch et al, 2024), the Government presented proposals in four areas based on SOU 2022:33. These include that:

- Change permits should become standard when applying for changes to parts of environmentally hazardous activities;
- It should be possible to extend the validity of permits;
- Fewer cases will require a permit by making it possible to issue a permit order in cases of significant environmental impact, and the role of county administrative boards will be developed to make it easier to decide cases without a main hearing; *and*
- Increased scope for digital processing.

**The government inquiry's analyses and proposals have been essential to the expert group's discussions. Many concrete proposals are on the table. They provide politicians with an excellent basis for improving the regulations, clarifying guidelines, and providing resources to increase the competence of the administrators at the licensing authorities. It is, therefore, positive that the Government began work on the proposals presented in *Dagens industri* in May 2024.**



# 8. Sustainability assessments and green channels

»The Environmental Code provide guidelines for balancing different land-use interests. However, there is a lack of guidance and strategies at the national level to make trade-offs effectively at the local level.«

As mentioned in Chapter 7, during the discussion on current environmental assessments operators put forward views on greater weight being given to sustainability aspects. This would integrate environmental, economic and social factors into the evaluation. Ideas have also been put forward for creating 'green channels' for projects of particular importance to the transition to a fossil-free, sustainable society. These would involve simplified environmental assessments.

## Sustainability assessments

Having increased sustainability elements in environmental assessments has been analysed in scientific literature and in two government reports. What these have in common is a fundamental scepticism of the idea.

Pettersson and Söderholm (2019) argued that sustainability assessments have a different starting point from today's environmental assessments. The latter's primary function is to manage local environmental impacts and thus only to speak with the economists to internalise local external environmental effects. These authors also argued that the strength of today's environmental assessments is that they are precisely solid legal systems, with characteristic predictability and limitations.

Pettersson and Söderholm also pointed to a number of difficulties that arise from having more aspects of sustainability requirements in environmental assessments:

- The demands on companies' applications and documentation would increase because, compared with today's environmental assessments, there are more diverse areas and facts to be included. The resources and expertise of the case officers at the permitting authorities must then be increased to assess and deal with more information.

- Developing clear guidelines based on the considerations will not be easy. Several additional issues arise as a result of having a broader sustainability perspective. Difficulties in developing clear rules and guidelines also increase the scope for appeals.

- More sustainability issues mean that environmental, economic and social aspects must be weighed together. The question arises regarding how such an overall assessment should be reflected in the final permit. How should a company's global environmental benefits and employment effects be weighed against local environmental benefits? How should the different types of direct and indirect contributions to reducing greenhouse-gas emissions be assessed? And how should impacts over various time horizons be addressed?

## A 'green channel'

The issue of a 'green channel' (where activities considered to contribute to significant climate or environmental benefits are given priority in the assessment) has been investigated in the ministry memorandum *'Anpassad miljöprövning för en grön omställning'* (Ds 2018:38). The authors of

the memorandum chose not to recommend this approach; neither are any of the stakeholders interviewed favourable to the idea, nor do previous studies support it. The authors' argument is that:

- A political decision is needed to determine precisely which activities or measures are to be covered for a specific assessment.
- A clear definition of environmental improvement is needed in order to avoid complicated and time-consuming interpretation and assessment processes.
- An activity or measure can have various direct and indirect environmental effects. These can be assessed as positive or negative, temporary or permanent, cumulative or non-cumulative. Environmental effects can also occur in the short, medium or long terms. The challenges in weighing all these dimensions together make basic assessments difficult.
- Extra resources would be required for the authorities involved in the permitting processes. Some staff would also need to work solely on the 'green channel.

Among other things, the EU's Critical Raw Materials Act provides for the identification of so-called strategic projects that can strengthen the EU's extraction, processing and recycling of strategic raw materials. These projects will be given a 'green channel' by requiring permitting processes to take a maximum of 27 months (see Chapter 5).

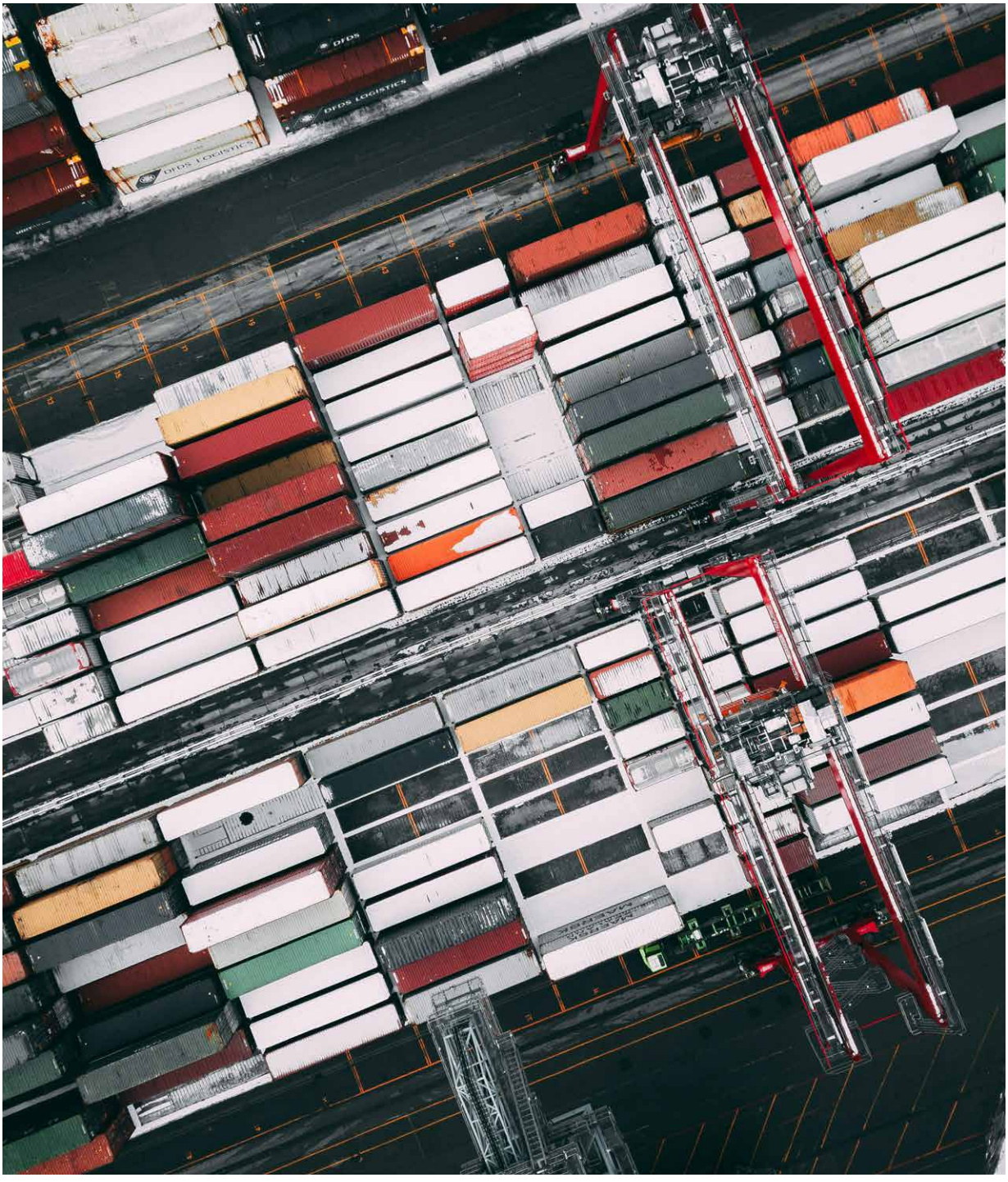
The new European Critical Raw Materials Board will identify strategic projects, and will consist of representatives of the Member States, chaired by a representative of the European Commission. Amongst others, Jernkontoret (the Swedish Steel Producers' Association) has criticised the idea of a special board to assess these projects (Svensson, 2023). The arguments are reminiscent of those in the Swedish debate on which selection criteria should apply to end up in a 'green channel'. A recently published research review also discusses the state's difficulties in setting these types of priorities through political and administrative bodies (Henrekson, 2024).

## Opportunities to integrate the sustainability perspective into current environmental assessments

Environmental assessment is based on the Environmental Code (SFS 1998:808). Its function ensures that activities are not excessively disruptive to the environment or unnecessarily wasteful of resources. The general rules of consideration in the Code (Chapter 4) set out several environmental requirements with which operators must comply. These requirements include knowledge, the best possible technology, resource management, and localisation. In addition, there are provisions on environmental quality standards (Chapter 7) and species protection.

The management provisions in Chapter 3 of the Environmental Code provide guidelines for balancing different land-use interests. Priorities can be set based on these guidelines; for example, for using land for a mine or forestry, and for reindeer husbandry. However, there is a lack of guidance and strategies at the national level to make these trade-offs effectively at the local level (SOU 2022:56) (see also the section *National ambitions and local reality*).

**Based on the provisions of the Environmental Code, in individual cases the Government has the opportunity to assess a permit on the basis that sustainability dimensions other than environmental interests should be prioritised. There is thus scope for policy to weigh up conflicting objectives and interests, albeit to a limited extent. However, if this type of review occurs regularly, there is an increased risk that predictability and legal certainty in the system will be reduced – which is a main point of the criticism of having 'green channels'.**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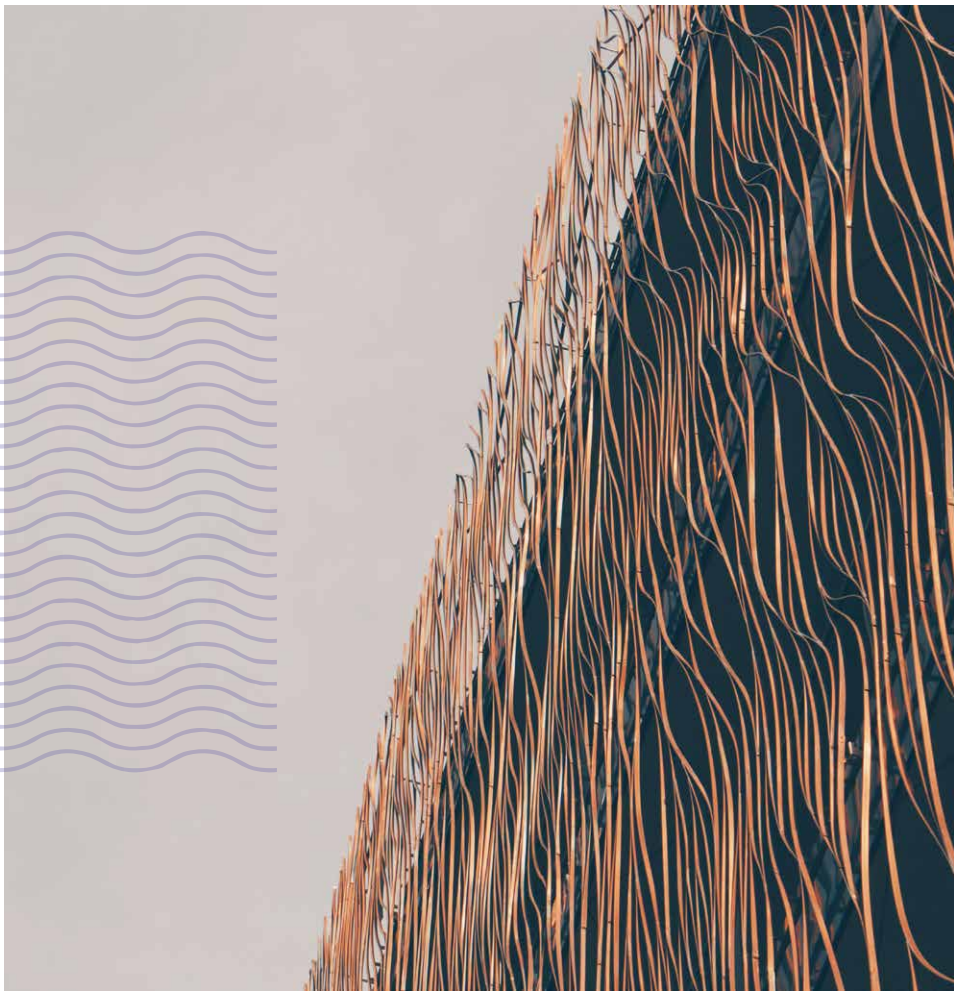


# 9. Objectives and conflicts of interest – the policy challenges

»Among the political challenges regarding the supply of metals and minerals is Sweden's international responsibility for the supply of critical metals and minerals.«

This IVA project focuses on the choices required in order to secure the supply of metals and minerals in Sweden in light of the work done on these issues within the EU. Two factors will determine the development of demand for critical metals and minerals:

- How consumption patterns evolve in today's rich and poor countries?
- How technology development enables increased resource efficiency and substitution between different materials. A key question is which technologies will be used to increase material wealth in developing countries as their economies and populations grow.

While Sweden has a well-developed mining sector, we are only beginning to exploit deposits of critical metals and minerals. EU cooperation, formalised in the Critical Raw Materials Act (CRMA), puts pressure on Sweden to explore and to create opportunities for realising our geological potential.

When this happens, several conflicts of objectives and interests will be brought to the fore, just as they have arisen in the exploitation of various natural resources throughout Sweden's industrialisation since the 19th Century. Some of these conflicts can be managed within the permitting processes that we discussed earlier. The solution to others lies in decisions in political processes at both local and national levels.

The report *'En tryggad försörjning av metaller och mineral'* (SOU 2022:56) points to two challenges to implementing the greater extraction of critical metals and minerals:

- Social consent from residents to mining activities; *and*
- National planning is not sufficient to have a practical local impact.

In this chapter, we address four aspects of the policy challenges that the expert group believes are associated with the management of conflicting objectives and interests related to the supply of metals and minerals:

- Sweden's international responsibility for the supply of critical metals and minerals;
- Ownership of metals and minerals – legislation and social acceptance;
- Conflicts of interest and objectives in land use; *and*
- The tension between national ambitions and local reality.

## Sweden's international responsibility

If Sweden chooses to mine more and more metals and minerals, it means new mines – underground or open pit. That creates conflicts of objectives, the solutions to which the expert group believes depend on the answers to three questions that are related to conflicts of objectives:

- What is Sweden's international responsibility, and what role should we play in transitioning to a fossil-free, sustainable society?

- What environmental and other sustainability costs are we prepared to bear if we contribute as much of our metal and mineral resources as possible? and

- To what extent should Sweden rely on imports from other countries with less favourable environmental and other sustainability requirements?

The first conflict of objectives is between leaving nature untouched and accepting local environmental and social impacts. Uranium mining for nuclear power exemplifies how we have solved the issue. Sweden accepts the operation of several nuclear power plants, and building new nuclear power is high on the current Government's political agenda. At the same time, the mining of domestic uranium

resources has been banned since 2018. (The government now wants to change this, and set up an inquiry that was completed in mid-2024.) Instead, Sweden relies on importing uranium, with the local environmental impact that this entails in the country where it is mined.

The second conflict of objectives concerns sustainability. What environmental impact and working conditions are we prepared to accept in mining operations outside Europe? The answer affects Sweden's need to use its own resources. The CRMA sets out sustainability requirements for imports from other countries. However, it is too early to say how these will be applied in practice.

The third conflict of objectives concerns the trade-off between investments in Sweden and outside the EU. Suppose that an investment in an African country to extract critical metals is economically more efficient than in Sweden or in Europe. Then, according to classical economic theory on the benefits of the international division of labour, the investment should be made in the African country (Leamer, 1995). Are we then prepared to invest taxpayers' money through direct investments or credit guarantees in a country outside Sweden and the EU? The CRMA states that strategic projects may involve investments outside Europe. Here, too, it remains to be seen how this will happen in practice, not least in light of how state-aid rules for industrial investments are applied in different Member States.

**The ongoing preparation of a Swedish mineral strategy, where the CRMA can be seen as a framework, should include the international role that Sweden should play as a mining nation. It should also involve taking a position on conflicting objectives relating to sustainability issues, and considering the effectiveness of investments in Sweden compared with developing countries.**

## Ownership of the subsoil – the legitimacy of, and knowledge about, current legislation

A landowner's rights to metals and minerals have long been limited. The roots of the legislation go back to the 16th Century, when the state asserted its right to extract metals and minerals on favourable terms. The legislation has changed, but the basic principle of an exception to the ownership of metals and minerals remains the same today (Bäckström, 2015).

The mining industry has historically been concentrated in central and northern Sweden. That has meant that any resulting conflicts of interest relating to land use have been managed with the help of legislative instruments involving compensation to landowners. Conditions are different, however, when extraction is to take place in areas where there has been not been mining before.

One example is the exploration for vanadium in Österlen in 2019–2021. In the local debate, it appeared that the company's exploration meant that mining was imminent, a position that was also underlined in the position put forward by the Veto nu organisation under the slogan "No mines here, please!". The company also contributed to this picture in interviews by describing in detail how future mining would take place. As a result, many of the arguments in the discussion came to be about something other than the consequences of the exploration then in progress (Reimers, 2019).

Many of the farmers on whose land the exploration was planned were also completely unsympathetic to the fact that the state could claim their land and allow exploration. The compensation for this and for any possible future mining was perceived as being ridiculously small compared to the value beneath their soil that would be realised when extracting the vanadium (Reimers, 2019)

The inquiry into Sweden's future supply of critical metals and minerals (SOU 2022:56) believes that parts of the Minerals Act are archaic and that the operating system for them is incomplete. For this reason it proposes a complete over-

haul of the regulatory framework for the primary[4] and secondary[5] extraction of metals and minerals to adapt it to modern requirements and needs.

**There is a pressing need to increase knowledge about the different steps from exploration to mining. A challenge for policymakers is to explain the background and logic of current legislation, and how to modernise it. That is often a thankless position in the heated debate arising from exploiting metal and mineral resources in areas where mining activities are uncommon.**

## Competition for land use

Resolving issues of competing land uses, not least concerning the supply of critical metals and minerals, is fundamentally about complex conflicts of objectives at the societal level. Which use of land and other resources should be prioritised? Is it forestry, hunting and fishing, reindeer farming, agriculture, water resources or the needs of the armed forces that are to be met (see Figure 9)?

There is often a call for a holistic government approach to land and water planning to manage the transition to a fossil-free, sustainable society. However, it has become more difficult to take such a holistic approach because of the existence of an increasing number of national goals, plans and programmes, together with new commitments through international agreements and common legislation within the EU (Boverket, 2022).

Solving these issues requires national priorities that can be translated into local decisions. In its 2022 report *'Framework for National Planning'*, the Swedish National Board of Housing, Building and Planning *(Boverket)* has stated that many planning actors perceive the national level in the current planning system as reactive and unclear. Coordination between government agencies is inadequate, and governance is insufficient. Boverket has worked on the issue, noting that there is currently no formalised cross-sectoral collaboration and that few joint documents and analyses are made from a holistic perspective.

In the debate, ideas have been put forward for a special sustainability authority to deal with these over-arching issues (Svemin, 2021). Another example of creating this holistic perspective is the Parliamentary Environmental Objectives Committee, which was set up by the Government in 2010 to achieve broad political consensus on several different environmental issues. The aim is also to deal with issues that affect several societal interests in different areas that are particularly prioritised and complex; issues that cannot be resolved at the government level but which require political considerations.

Figures 10 and 11 show that metals and minerals are found in large parts of Sweden, even in areas where mining has not yet taken place. The Environmental Code provides the state with tools for overall planning of the use of land and water areas in Sweden; this is done through the management provisions in Chapters 3 and 4 of the Code. These are designed to enable priorities to be set between different interests, and when these change over time.

National spatial planning in Sweden is based on the state setting national objectives. The national planning tools used are national interests that are designated by national sectoral authorities such as the Swedish Environmental Protection Agency, the Swedish Energy Agency, and the National Heritage Board. The purpose may be the preser-

4 Extraction from mining.

5 Extraction from landfills or mining waste, for example.

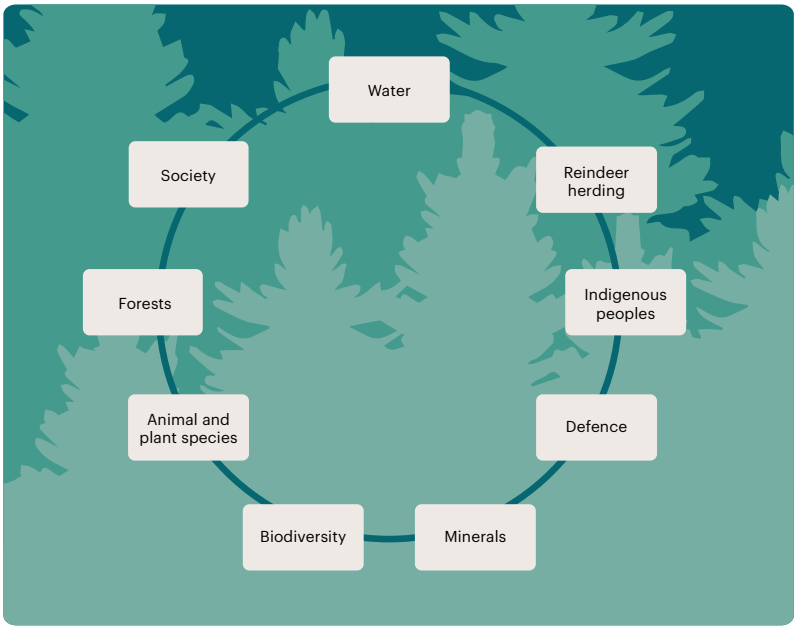



**Figure 9:** Examples of conflicting interests in the use of forest and mineral resources

vation of a particular environment or the exploitation of a natural resource.

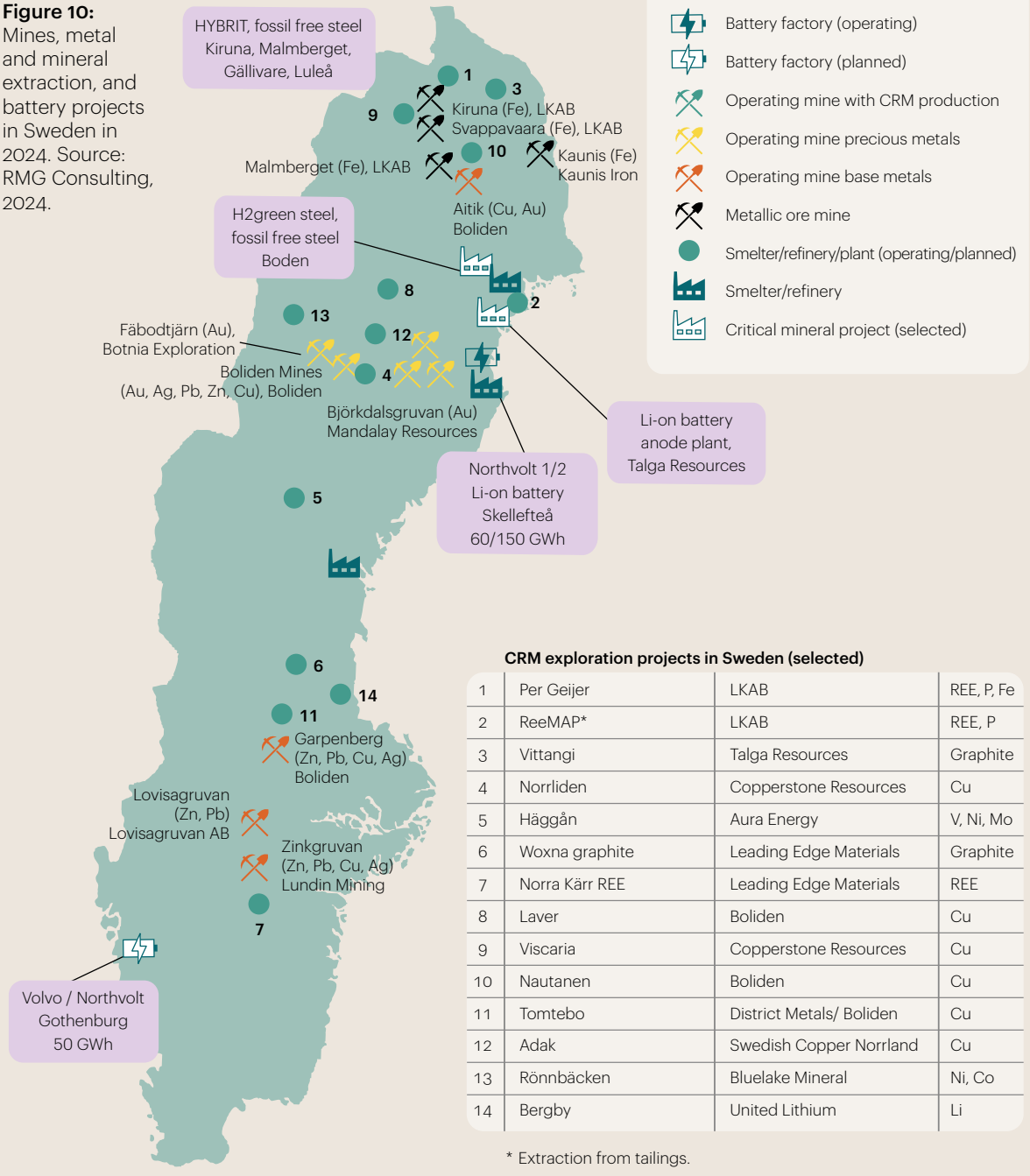
Municipalities must implement the intentions behind national interests in their planning work and decisions under the Planning and Building Act. Comprehensive planning must show how national interests are weighed against each other and against other interests within the municipality.

The expansion of hydropower provides a historical example of community planning. After discussions between the political parties, the Government and parliament decided which rivers should be exploited. In 1993, it was decided that the Torne, Kalix, Pite and Vindel would be national rivers – that is, national interests protected under Chapter 4 of the Environmental Code. We believe that such a decision on national land-use prioritisation in different areas could be an opportunity to deal with the recurring conflicts of interest between the mining and reindeer industries.

A report from the government inquiry into a sustainable supply of innovation-critical metals and minerals (SOU 2022:56) proposes that the SGU should intensify its efforts to identify areas of national interest that contain deposits of critical metals and minerals. That means that they can be managed within the framework of the Environmental Code's mechanisms for balancing and prioritising between different national interests. At the same time, the report points out that EU environmental-protection law limits the possibilities of making such priorities because of its completely binding legislation. Long-term work is therefore needed at the EU level to ensure that the application of EU legislation allows different interests to be balanced against each other differently than at present.

**Current legislation allows trade-offs between different societal interests within the framework of environmental legislation. However, these trade-offs require clear national guidelines that can guide local decisions. Such guidelines are lacking today.**

**Figure 10:** Mines, metal and mineral extraction, and battery projects in Sweden in 2024. Source: RMG Consulting, 2024.




**CRM exploration projects in Sweden (selected)**

| | | | |
|---|---|---|---|
| 1 | Per Geijer | LKAB | REE, P, Fe |
| 2 | ReeMAP* | LKAB | REE, P |
| 3 | Vittangi | Talga Resources | Graphite |
| 4 | Norrliden | Copperstone Resources | Cu |
| 5 | Häggån | Aura Energy | V, Ni, Mo |
| 6 | Woxna graphite | Leading Edge Materials | Graphite |
| 7 | Norra Kärr REE | Leading Edge Materials | REE |
| 8 | Laver | Boliden | Cu |
| 9 | Viscaria | Copperstone Resources | Cu |
| 10 | Nautanen | Boliden | Cu |
| 11 | Tomtebo | District Metals/ Boliden | Cu |
| 12 | Adak | Swedish Copper Norrland | Cu |
| 13 | Rönnbäcken | Bluelake Mineral | Ni, Co |
| 14 | Bergby | United Lithium | Li |

* Extraction from tailings.

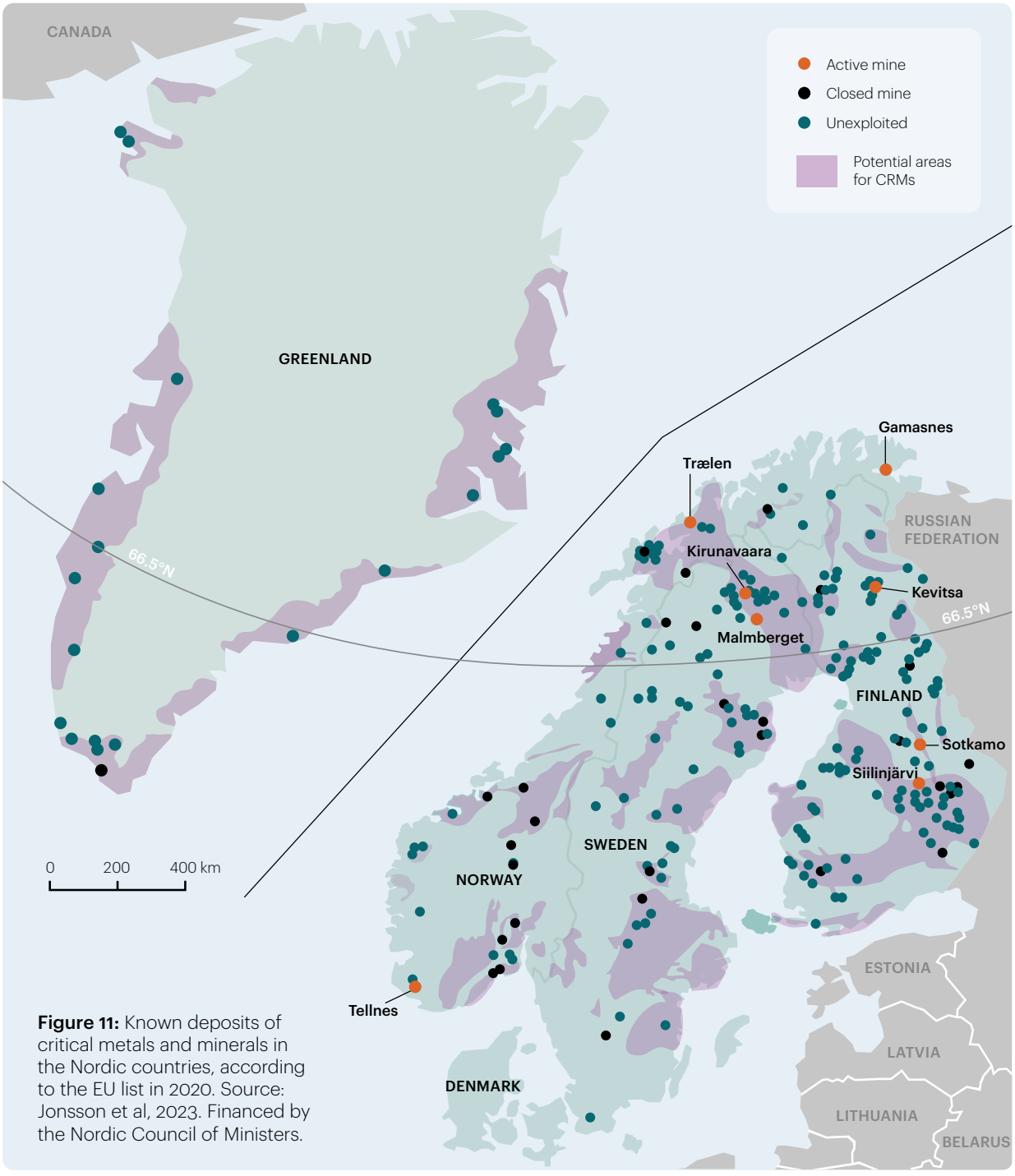



**Figure 11:** Known deposits of critical metals and minerals in the Nordic countries, according to the EU list in 2020. Source: Jonsson et al, 2023. Financed by the Nordic Council of Ministers.

# National ambitions and local realities

In the section *'Competition for land use'* (above), we described shortcomings in national spatial planning in Sweden. The consequence is that there are difficulties in realising national goals and ambitions through local decisions. There is therefore a risk that the often difficult trade-offs relating to the transition to a fossil-free, sustainable society will be made through local decisions without clear national guidelines.

Establishing a mining operation always has environmental consequences. The environmental impact assessment must ensure that these are acceptable in managing the country's land and water resources. In addition, an establishment always has political, local, economic and social dimensions. We discuss two aspects below:

- The difficult local economic equation in mining towns; *and*
- The need for local social acceptance of environmentally disruptive activities.

## A difficult local economic equation

We noted above that there is considerable opposition to plans for mining in areas where activities like that have not been common up to now, and this can be expected to continue in the future. But questions are also raised in places where there has been long-term mining, one reason being that the municipalities believe they do not receive sufficient economic benefit from the operations, a criticism that has been made for many years (Sveriges Radio, 2013).

Today, most of a municipality's revenue comes from the tax paid by its residents, the level of which the municipalities themselves decide. 75% of municipal funds are spent on welfare services such as schools, care for the elderly, and initiatives aimed at disabled people. Central government regulates these services, and also provides state subsidies. However, these subsidies cover only 25-30% of the municipalities' costs for these activities. Municipalities also benefit from central government cost equalisation and from the redistribution of tax revenue between municipalities. However, these revenues can only partially compensate for differences in local tax-raising capabilities (Larsson, 2021).

Sweden has long chosen a path where the local community does not directly benefit from a business establishment or infrastructure investment, such as hydropower, except for the tax from the employees registered in the locality. Business taxes are state taxes. This means that if a municipality is to benefit directly from an establishment, many of the employees must live there. Making this possible requires housing and good social services, which in many cases requires investment and risk-taking by the municipalities (Larsson, 2021; EIT RawMaterials). These issues have been brought to the fore by the big industrial businesses in Västerbotten and Norrbotten.

Sweden differs from its neighbouring countries regarding compensation to the local community. Our regional policy has a different focus compared with Norway, for example, where there is considerable support for rural municipalities. In Finland, local communities are compensated in other ways. In the case of exploration, for instance, a large part of the fee paid by the prospector goes back to the municipality in question. The same applies to the mining tax (Eriksson, 2019).

The report *'En tryggad försörjning av metaller och mineral'* (SOU 2022:56) proposed increased value-sharing with municipalities to improve the acceptance of mining projects in the locality. It proposed the establishment of a mining pot, the level of which is decided in the state budget, with the funds then being distributed between different areas of the country in proportion to the value of the ore produced. The distribution between communities affected by a mine would then be decided in consultation between the municipalities, the regions and the mining companies concerned. The process would also consider different structural conditions like infrastructure and housing.

**Benefitting nationally from metal and mineral resources and their impact on local communities without providing economic benefits to municipalities is an impossible equation. Sweden needs to rethink. Proposals are on the table.**

## Local social acceptance

A local community is always affected negatively by environmentally disruptive activities, while the effects of these can largely be positive from a national or international perspective. The difficulty lies in balancing these effects against each other; in short, in creating local acceptance for something that is of national benefit.

When some groups do not feel heard, or do not have the resources to make their voices heard, there is a risk of reducing social acceptance of change, and the risk of po-

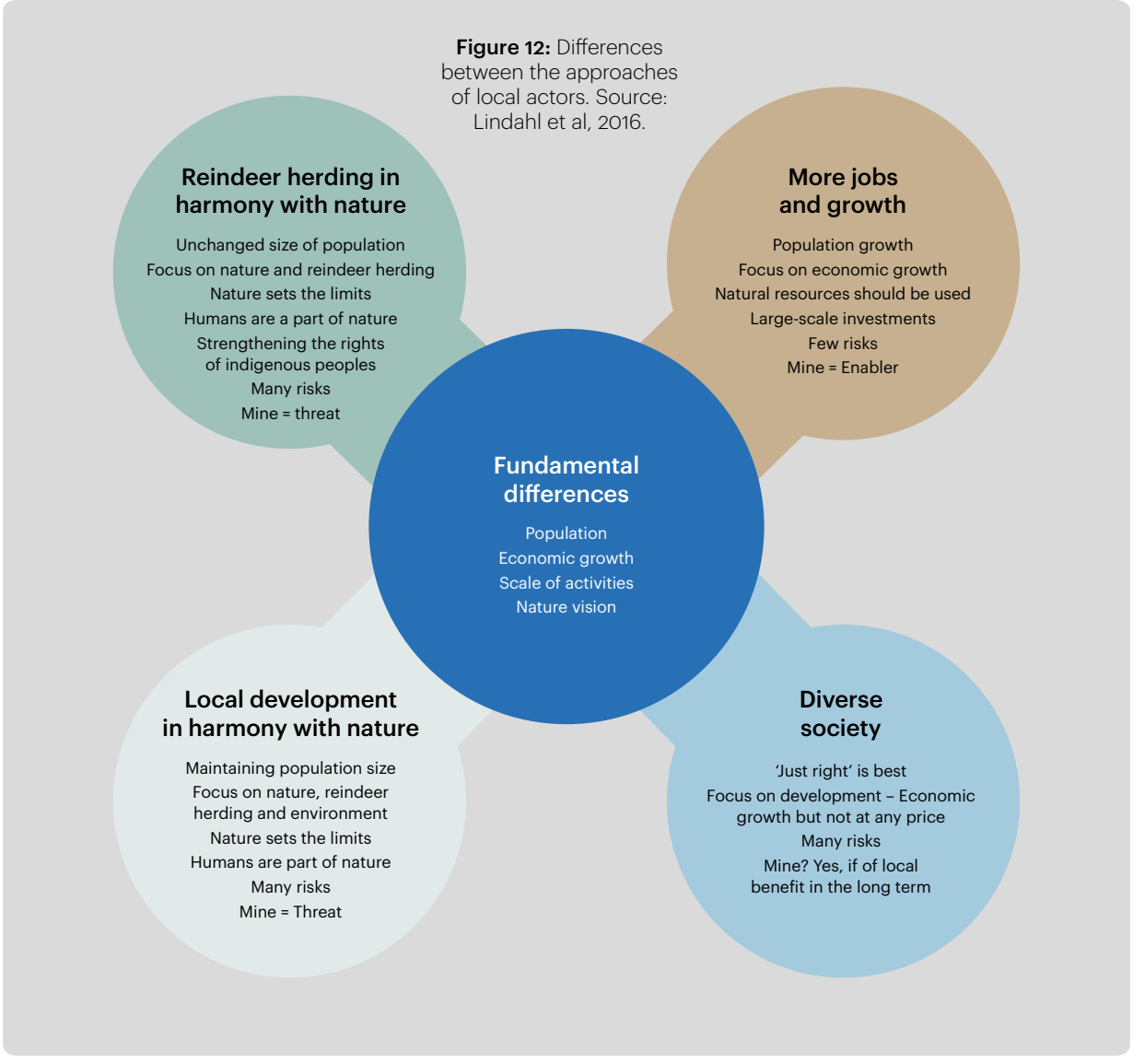



**Figure 12:** Differences between the approaches of local actors. Source: Lindahl et al, 2016.

larisation increases. Conversely, polarisation can be reduced by identifying neglected groups and by providing resources to give them a voice.

Significant differences exist between the resources of different interest groups to make their voices heard when conflicts of interest are managed, not least in legal processes linked to land use (Söderholm et al, 2022). One effect of the lack of resources is that it becomes difficult to gain an overview of one's situation and conditions, creating further uncertainty. Negotiating without knowing what is essential and what is negotiable can lead to poorer solutions. That reduces social acceptance and increases polarisation.

A range of options and proposals exists to increase local acceptance:

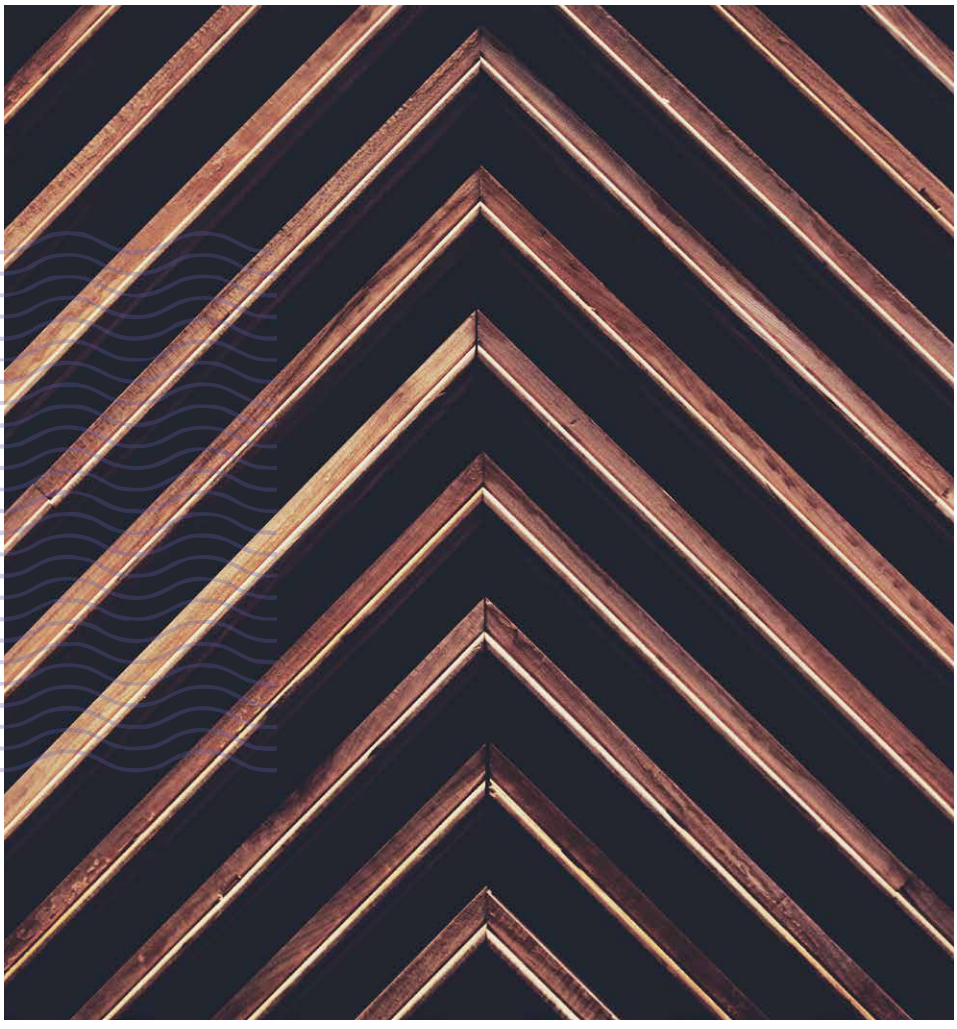
The approval process for mining activities is complicated and needs to be explained better to the local community. Awareness-raising efforts may also be required at the national level. Attitude surveys show that the further one is from areas with mining activities, the greater the opposition to mines. There may be several different explanations for this. In a research project, those involved used interviews to identify various aspects that influence the view of mining businesses. The study showed that stakeholders' views differ on the future, what is sustainable, what benefits the local community, and whether a mine contributes to or hinders local development (Lindahl et al, 2016).

Figure 12 illustrates four different approaches that the researchers identified in their case studies. The study shows that there can be resistance to new establishments even in areas with existing mines, such as Kiruna. Resolving conflicts rooted in fundamental values is difficult. All the same, a dialogue on equal terms can lead to some consensus, mutual understanding of each other's views, and decisions being perceived as legitimate (Lindahl et al, 2016).

The report *'En tryggad försörjning av metaller och mineral'* (SOU 2022:56) proposed that a requirement for early dialogue meetings should be introduced in the Minerals Act. It also proposed that exploration permit holders should compensate property owners, such as a Sami village or forest owner, for the work required to arrange an early dialogue meeting.

**Effective processes and political guidance are currently lacking to ensure that national priorities have a clear impact locally. That risks threatening confidence in the ability of environmental assessments to manage the conflicting objectives and interests of new mining operations, or changes to existing ones.**

**There are many reasons to ensure that different interest groups have sufficient resources to enable them to represent their viewpoints in a reasonable way.**



# 10. Bibliography

African Development Bank Group (2022). *Approach Paper toward preparation of an African Green Mineral Strategy, December 2022*. Retrieved from https://www.afdb.org/sites/default/files/documents/publications/approach_paper_towards_preparation_of_an_african_green_minerals_strategy.pdf

Andersson, P. (2023). *Kinas kontroll över sällsynta jordartsmetaller och vad den innebär för Sverige* [China's control over rare earth elements and what it means for Sweden]. Brief No 5, 2023, Nationellt kunskapscentrum om Kina. Retrieved from https://www.ui.se/globalassets/ ui.se-eng/publications/other-publications/kinas-kontroll-over-sallsynta-jordartsmetaller-och-vad-den-innebar-for-sverige.pdf

Anpassad miljöprövning för en grön omställning [Adapted environmental assessment for a green transition] (Ds 2018:38). Klimat- och näringslivsdepartementet. Retrieved from https://www.regeringen.se/rattsliga-dokument/departementsserien-och-promemorior/2018/10/ds-201838/

Arbets- och näringsministeriet (2010). *Finlands mineralstrategi* [Finland's Mineral Strategy]. Retrieved from http://projects.gtk.fi/export/sites/ projects/mineralstrategi/dokument/FinlandsMineralstrategi_1.pdf

Australian Government (2023). *Critical Minerals Strategy 2023–2030*. Retrieved from https://www.industry.gov. au/sites/default/files/2023-06/critical-minerals-strategy-2023-2030.pdf

Bergfald, B., Kristensen, K. & Lystad, H., (2024). *Recycling of Critical Raw Materials in the Nordics*, Nordic Concil of Ministers, TemaNord 2024:513. Retrieved from https://pub.norden.org/temanord2024-513/index.html

Boverket (2022). *Ramverk för nationell planering, Förslag till utvecklad nationell planering i Sverige, slutrapport mars 2022* [Framework for national planning, Proposal for developed national planning in Sweden, final report March 2022]. Retrieved from https://www.boverket.se/globalassets/publikationer/dokument/2022/ramverk-for-nationell-planering---slutrapport.pdf

Busch, E., Pourmokhtari, R. & Svantesson, E. (2024, May 6) *Nu tas nästa steg för snabbare och enklare tillståndsprocesser* [Introducing the next step for faster and simpler permit review processes]. Dagens Industri. Retrieved from https://www.di.se/ debatt/nu-tas-nasta-steg-for-snabbare-och-enklare-tillstandsprocesser/

Bäckström, L. (2015). *Svensk gruvrätt: En rättsvetenskaplig studie rörande förutsättningarna för utvinning och mineral* [Swedish mining law: A legal study of the conditions for mining and minerals]. [Doktorsavhandling, Luleå tekniska universitet.] Retrieved from https://urn.kb.se/resolve?urn=urn:n bn:se:ltu:diva-18100

Consilium (2024, April 18). *En EU-akt om kritiska råvaror för EU:s framtida leveranskedjor* [An EU Act on Critical Raw Materials for the EU's future supply chains]. Europeiska rådet och Europeiska unionens råd. Retrieved from https://www. consilium.europa.eu/sv/infographics/critical-raw-materials/

Eilu, P., Bjerkgård, T., Franzson, H., Gautneb, H., Häkkinen, T., Jonsson, E., Keiding, J.K., Pokki, J., Raaness, A., Reginiussen, H., Róbertsdóttir, B.G., Rosa, D., Sadeghi, M., Sandstad, J.S., Stendal, H., Þórhallsson, E.R. & Törmänen T. (2021). *The Nordic supply potential of critical metals and minerals for a Green Energy Transition. Nordic Innovation.* Retrieved from https://www.nordicinnovation. org/2021/nordic-supply-potential-critical-metals-and-minerals-green-energy-transition

EIT RawMaterials (n.d.). *Vem tjänar på gruvan?* [Who profits on the mine?] MineFacts. Retrieved May 13, 2024, from https://www.minefacts. eu/vamtjanarpa-gruvan

En tryggad försörjning av metaller och mineral [Security of supply of metals and minerals] (SOU 2022:56). Betänkande från Utredningen om en hållbar försörjning av innovationskritiska metaller och mineral, N 2021:01. Klimat- och näringslivsdepartementet. Retrieved from https://www.regeringen.se/rattsliga-dokument/statens-offentliga-utredningar/2022/10/sou-202256/

Eriksson. J.A., (2019, September 3). *Det norska och svenska tillståndet* [The state of Norway and Sweden], Kvartal. Retrieved from https://kvartal.se/artiklar/ det-norska-och-det-svenska-tillstandet/

Evenett., S. & Fritz., J. (2023, July 19). *Revisiting the China-Japan Rare Earths dispute of 2010*. Vox-EU CEPR. Retrieved from https://cepr.org/voxeu/columns/revisiting-china-japan-rare-earths-dispute-2010

Fastighetsbildningslag (SFS 1970:988)

Fossilfritt Sverige (2023), *Färdigutredda förslag för effektivare tillståndsprocesser* [Finalised proposals for more efficient permit reviews]. Retrieved from https:// fossilfrittsverige.se/wp-content/uploads/2023/04/ Fardigutredda-forslag-for-effektivare-tillstandsprocesser-Fossilfritt-Sverige.pdf

Government of Canada (2022). *The Canadian Critical Minerals Strategy*. Retrieved from https://www.canada.ca/content/dam/nrcan-rncan/site/critical-minerals/Critical-minerals-strategyDec09.pdf

Henrekson, M., Sandström, C. & Stenkula, M. (2024). *Moonshots and the New Industrial Policy. Questioning the Mission Economy*. International Studies in Entrepreneurship Volume 56. Retrieved from https://library.oapen.org/bitstream/handle/20.500.12657/87626/978-3-031-49196-2.pdf

Hool, A., Helbig, C. & Wierink, G. (2023). *Challenges and opportunities of the European Critical Raw Materials Act*. Mineral Economics. Retrieved from https://doi.org/10.1007/s13563-023-00394-y

IVA (2021), *Hållbar vattenförsörjning i urbana miljöer* [Sustainable water supply in urban environments]. Kungl. Ingenjörsvetenskapsakademien (IVA). Retrieved from https://www.iva.se/publicerat/rapport-hallbar-vattenforsorjning-i-urbana-miljoer/

IVA (2024 a). *Challenges for Meeting Increased Demand for Metals and Minerals*. Kungl. Ingenjörsvetenskapsakademien (IVA). Retrieved from https://www.iva.se/en/published/report-challenges-for-meeting-increased-demand-for-metals-and-minerals/

IVA (2024 b). *Circular Flows to Meet Increased Demand for Metals and Minerals*. Kungl. Ingenjörsvetenskapsakademien (IVA). Retrieved from https://www.iva.se/en/published/report-circular-flows-to-meet-increased-demand-for-metals-and-minerals/

Jonsson, E., Törmänen, T., Kløve Keiding, J., Bjerkgård, T., Eilu, P., Pokki, J., Gautneb, H., Reginiussen, H., Rosa, D., Sadeghi, M., Sandstad, J. S. & Stendal, H. (2023). *Critical metals and minerals in the Nordic countries of Europe: diversity of mineralization and green energy potential*. Geological Society, London, Special Publications, 526, Pages 95-152. Retrieved from https://www.lyellcollection.org/doi/abs/10.1144/ SP526-2022-55

Larsson, T. (2021). *Den politiska maktens organisering i Sverige och dess motsättningar* [The organisation of political power in Sweden and its contradictions]. Kungl. Ingenjörsvetenskapsakademien (IVA). Retrieved from https://www.iva.se/contentassets/9aeb23be003d41adac972f66066e8529/whitepaper-2021---den-politiska-maktens-organisering-i-sverige.pdf

Leamer, E. (1995). *The Heckscher-Ohlin model in theory and practice*. Princeton studies in international finance, no 77. Retrieved from https://www.researchgate.net/publication/5072851_The_Heckscher-Ohlin_Model_in_Theory_and_Practice

Lindahl, K. B., Zachrisson, A., Wiklund, R., Matti, S., & Fjellborg, D. (2016). *Fjällnära Gruvdrift?: Konflikter om vägar till hållbarhet* [Mining in the mountains?: Conflicts over pathways to sustainability]. Luleå tekniska universitet. Retrieved from https://urn.kb.se/resolve?urn=urn:nbn:s e:ltu:diva-60975

Matthis, S. (2023, December 14). *Svemin välkomnar nya Critical Raw Materials A*ct [Svemin welcomes the new Critical Raw Materials Act]. Industriny-heter. Retrieved from https://www.industrinyheter.se/20231215/38428/svemin-valkomnar-nya-critical-raw-materials-act

Miljöbalk (SFS 1998:808)

Minerallag (SFS 1991:45)

Naturskyddsföreningen (2023). *Till miljölagarnas försvar. En granskning av myter om miljölagarna.* [In defence of environmental laws. A review of myths about environmental laws.] Retrieved from https://cdn.naturskyddsforeningen. se/uploads/2024/04/33880_316cecf08f6855e.pdf

Naturvårdsverket (2023). *Uppdrag att analysera statistik för miljötillståndsprövningen under 2022* [Mandate to analyse statistics for the environmental permit review process in 2022]. Redovisning av regeringsuppdrag KN2023/03355. Retrieved from https://www.naturvardsverket. se/4acdf4/contentassets/5884905c391e4fe4b402 0a81a57c525c/uppdrag-att-analysera-statistik-for-miljotillstandsprovningen-2022.pdf

Nilén, A. (2024, April 7). *10 miljoner för effektivare tillståndsprövningar* [10 million for more efficient permit reviews]. Lantbruksnytt. Retrieved from https://lantbruksnytt.se/10-miljoner-for-effektivare-tillstandsprovning/

Nærings- och fiskeridepartementet (2023). *Norges mineralstrategi* [Norway's Mineral Strategy]. Retrieved from https://www.regjeringen.no/no/dokumenter/norges-mineralstrategi/id2986278/

North, D.C., (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press. Retrieved from https://doi.org/10.1017/ CBO9780511808678

Näringsdepartementet (2013). *Sveriges mineralstrategi* [Sweden's Mineral Strategy]. Regeringskansliet. Retrieved from https://www.regeringen.se/contentassets/b740a83ce76e4b1cad799c9e7fc573b6/sveriges-mineralstrategi.-for-ett-hallbart-nyttjande-av-sveriges-mineraltillgangar-som-skapar-tillvaxt-i-hela-landet-del-1-av-2

Om prövning och omprövning – en del av den gröna omställningen [On assessment and reassessment – part of the green transition] (SOU 2022:33). Betänkande av Miljöprövningsutredningen. Klimat- och näringslivsdepartementet. Retrieved from https://www.regeringen.se/rattsliga-dokument/statens-offentliga-utredningar/2022/06/sou-202233/

Pettersson, M. & Söderholm, P. (2019). *Miljölagstiftningens betydelse för stora kunskapsintensiva investeringar* (PM 2019:15) [The importance of environmental legislation for large knowledge-intensive investments (PM 2019:15)]. Tillväxtanalys. Retrieved from från https://www. tillvaxtanalys.se/publikationer/pm/pm/2019-12-11-miljolagstiftningens-betydelse-for-stora-kunskapsintensiva-investeringar.html

Plan- och bygglag (SFS 2010:900)

Pope, N. & Smith P. (2023). *Brazil's critical and strategic minerals in a changing world*. Igarapé Institute. Retrieved from https://igarape.org.br/wp-content/uploads/2023/10/Critical-and-Strategic-Minerals.pdf

Reimers, C.-V., (2019, November 10). *Vad hindrar den svenska gruvboomen?* [What is holding back the Swedish mining boom?] Smedjan. Retrieved from https:// timbro.se/smedjan/vad-hindrar-den-svenska-gruvboomen/

Rossbach, N. (2023). *Rare metals and great power rivalry – an overview about the risk for new resource wars* (FOI-R--5478--SE). Totalförsvarets forskningsinstitut. Retrieved from https://www.foi.se/en/foi/reports/report-summary.html?reportNo=FOI-R--5478--SE

Sandahl, J., & Alarik, O. (2023, May 9) *Lögner och myter en del av kampanjen mot miljölagar* [Lies and myths part of the campaign against environmental laws]. Dagens Nyheter. Retrieved from https://www.dn.se/debatt/logner-och-myter-en-del-av-kampanjen-mot-miljolagar/

Schön, L., (2014). *En modern ekonomisk historia* (4:e uppl.) [A modern economic history (4th ed.)]. Studentlitteratur.

Sharma, A. (2023, May 11). *The challenges ahead for South Korea's critical minerals strategy.* Korea Pro. Retrieved from https://koreapro.org/2023/05/the-challenges-ahead-for-south-koreas-critical-minerals-strategy/

Skår, N. (2022, May 30). *Klimatet har inte tid att vänta på tillstånd* [The climate has no time to wait for permits]. Svenskt Näringsliv. Retrieved from https://www.svensktnaringsliv.se/sakomraden/hallbarhet-miljo-och-energi/klimatet-har-inte-tid-att-vanta-pa-tillstand_1186279.html

Skår, N. (2023, May 12) *Missvisande av Naturskyddsföreningen om handläggningstider* [Misleading by the Swedish Society for Nature Conservation about processing times]. Dagens Nyheter. Retrieved from https://www.dn.se/debatt/missvisande-av-naturskyddsforeningen-om-handlaggningstider/

Svemin (2021). *Svemins reformpaket för effektiva tillståndsprocesser* [Svemin's reform package for efficient permit reviews]. Retrieved from https:// wwwsveminse. cdn.triggerfish.cloud/uploads/2021/10/svemins_reformpaket_es.pdf

Svensson, M. (2023, May 3). *Jernkontoret: Politiker ska inte ge vissa EU-projekt gräddfil* [Jernkontoret: Politicians should not give preferential treatment to certain EU projects]. Bergsmannen. Retrieved from https://www.bergsmannen.se/nyheter/e/6357/jernkontoret-politiker-ska-inte-ge-vissa-eu-projekt-graddfil/

Sveriges geologiska undersökning (2022 a), *Bergverksstatistik 2022* [Statistics of the Swedish Mining Industry 2022]. Retrieved from https://www.sgu.se/globalassets/produkter/publikationer/2023/bergverksstatistik-2022.pdf

Sveriges geologiska undersökning (2022 b), *Årsredovisning 2022* [Annual Report 2022]. Retrieved from https://www.sgu.se/globalassets/om-sgu/arsredovisningar/sgu-arsredovisning-2022.pdf

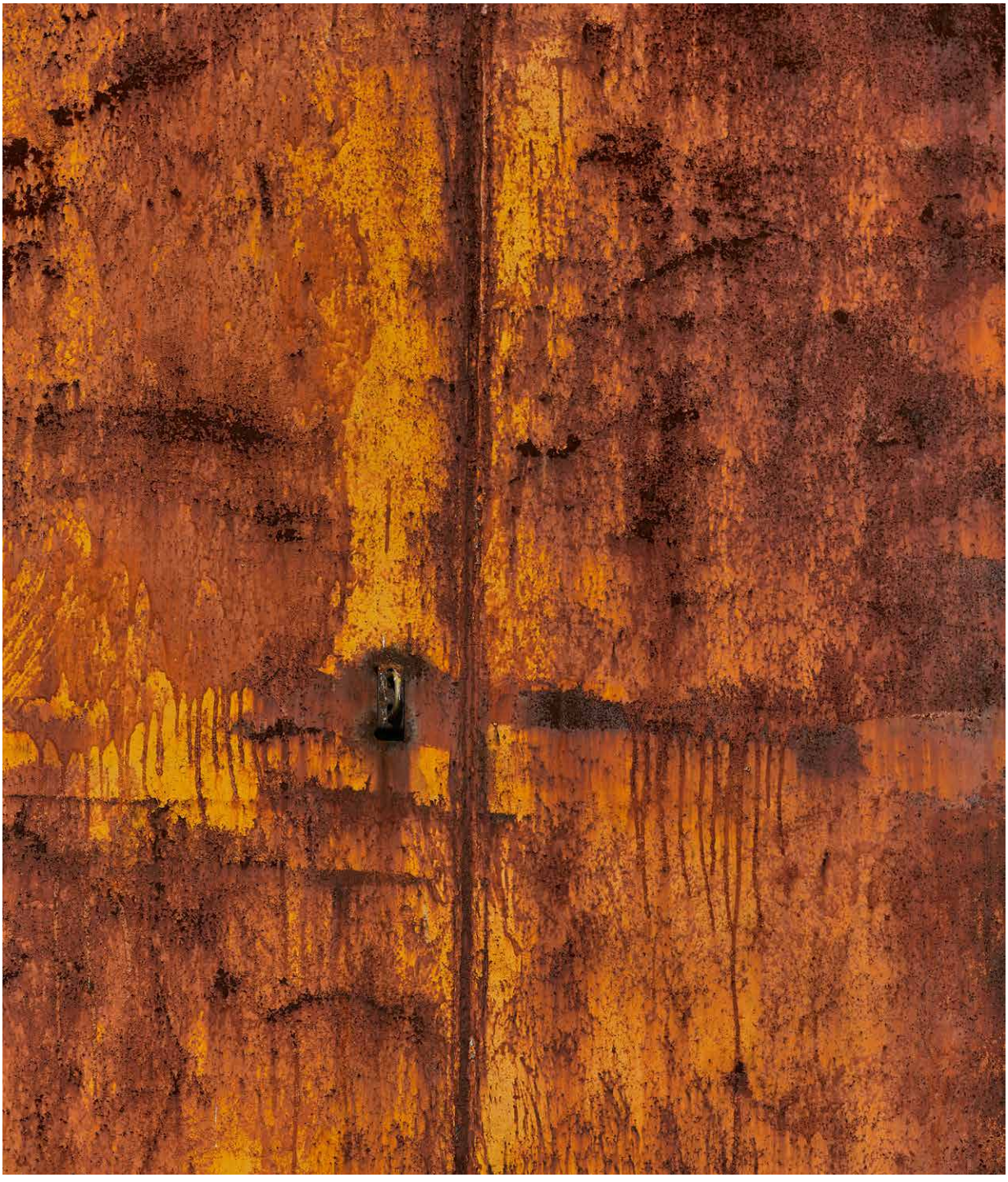
Sveriges Radio (2013, February 14). *Många av kommunernas politiska ledare vill ha skatt på gruvor* [Many local political leaders want a tax on mining]. Retrieved from https://sverigesradio.se/artikel/5443855

Sveriges Television, (2024, 20 March, 19:30). *Rapport* [TV programme].

Söderholm, P., Bergquist, A.-K., Maria, P. & Söderholm, K. (2022). *Miljölagstiftningen och industrins framtida konkurrenskraft: Lärdomar från 50 år av tillståndsprövningar* [Environmental legislation and the future competitiveness of industry: Lessons learnt from 50 years of permit reviews]. Entreprenörskapsforum. Retrieved from https://urn.kb.se/resolve?urn=urn:nbn:se:umu:d iva-200056

Söderholm, P., Pettersson, M. & Söderholm, K. (2016), *Miljöprövning och konkurrenskraft i gruvindustrin – lärdomar från Sverige, Finland, Australien och Kanada (PM 2016:09)* [Environmental assessment and competitiveness in the mining industry — lessons from Sweden, Finland, Australia and Canada (PM 2016:09)]. Tillväxtanalys. Retrieved from https:// www.tillvaxtanalys.se/publikationer/pm/pm/2016- 06-29-miljoprovning-och-konkurrenskraft-i-gruvindustrin----lardomar-fran-sverige-finland-australien-och-kanada.html

U.S. Department of Commerce (2019). *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals.* Retrieved from https://www.commerce. gov/sites/default/files/2020-01/Critical_Minerals_Strategy_Final.pdf



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