

metals

For
generations
to come



Biodiversity provides
vital balance

Climate-smart transport

How mines
and smelters work

5

QUICK QUESTIONS

How to apply
for a job
at Boliden



Europe's producer of sustainable metals for the climate transition

Society is facing a huge climate transition. If we are to cope with this, we need metals. As we see it, the road to a fossil-free society begins in many ways in our mines and smelters.

We have to pick up the pace if we are to cope with climate transition, which means having to reduce the use of fossil fuels through electrification and by finding new, innovative solutions. This is where Boliden's metals are crucial, as they make these new technologies possible.

We also need more metals than are produced today if we are to deal with climate transition. However, such metals must be produced as responsibly and with as little negative impact as possible. Boliden is at the forefront of its indus-

try in terms of both technological development and sustainability, and we are therefore part of Europe's green industrialization. We also know that there are no short cuts on the road to long-term success.

In this magazine you can read more about our operations, and what we are doing to modify our production to enable us to extract metals for generations to come. That work starts with our purpose, our vision and our values.

JOIN US!

Follow Boliden on social media



Follow our units on Instagram

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@boliden_garpenberg @boliden_kokkola
@boliden_aitik @boliden_kevitsa
@boliden_odda @bolidenbergsoe

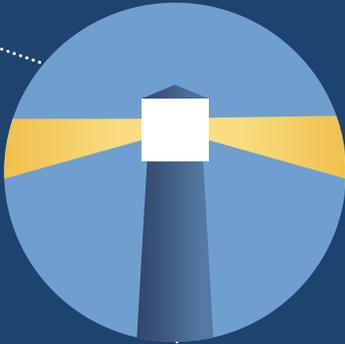


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OUR PURPOSE

To provide the metals essential to improve society for generations to come.



OUR VISION

To be the most climate friendly and respected metal provider in the world.

OUR VALUES



CARE

We trust in people and care about the safety and wellbeing of ourselves and others. We care about the environment and climate change. We care about our business, stakeholders and society.

COURAGE

We have the courage to challenge existing ways of working, learn and improve. We have the courage to take initiatives, make decisions and to act. We have the courage to stand up for what is right and speak up if something is wrong.

RESPONSIBILITY

We are reliable, deliver on our promises and take responsibility for our actions. We take responsibility to act as ambassadors for Boliden. We are responsible to make Boliden better through continuous improvements and innovations.

Boliden is a metals company with a focus on sustainable development. Our roots are Nordic, our market global. Our core competence lies within the fields of exploration, mining, smelting and metal recycling. Boliden has around 6,000 employees and annual sales of approximately SEK 85 billion. The share is listed in the Large Cap segment on NASDAQ OMX Stockholm.



Our value chain

We engage in exploration, extraction and processing of metals in a responsible way. Our ability to influence the value chain of metals means that we can produce metals with a significantly lower carbon footprint than the global average.

We already offer several such products, produced using recycled materials and raw materials from our own mines in Sweden, Finland and Ireland. These products, where they are used, can have a major impact on the overall carbon footprint of projects that require large quantities of copper and zinc.



Exploration

Exploration involves the long-term work of identifying, investigating and analyzing mineral deposits in order to examine the conditions for potential mining. In the first instance, exploration takes place in areas with existing mines. Authorities and landowners are kept informed of our exploratory activities.



Mining

We extract ore from both open pits and underground mines. A number of our mines enjoy world-class productivity, thanks in part to our expertise in mine design, mining methods and technological developments. That said, the safety of people and the environment is always our top priority.



Concentration

Mined ore is crushed and transported to concentrators in each mining area. Various metal concentrates are produced at these sites, the majority of which are transported to Boliden's smelters. Boliden has established mobile control rooms at the concentrators, where operators have access to process data in real time via wireless technology.



Raw materials

The smelters are supplied with metal concentrates from Boliden's mines, as well as with concentrates and secondary raw materials from external suppliers. The secondary raw materials include metals from car batteries or circuit boards from computers, phones, etc. Metals can be recycled without this affecting quality.

Metal production

The smelters process mineral concentrates, producing pure metals. Technical expertise and flexible processes mean that Boliden can produce metals from different types of concentrates. Maximizing the production of metals and by-products enables us to offer a broader product portfolio, while minimizing the amount of residual waste that has to be dealt with.

Sales

Metals are traded and priced on global exchanges. Most of Boliden's metal production is exported to countries within Europe that have a shortage of metals. For that reason, Europe also receives imports from other continents.

Metals and the climate



THE INTERNATIONAL COUNCIL ON MINING AND METALS (ICMM)

Boliden is a member of the International Council on Mining and Metals (ICMM), an international organization dedicated to a safe, fair and sustainable mining and metals industry. Through our membership, we undertake to comply with ICMM's principles, including those on climate performance and reclamation. We share the long-term goal of achieving net zero carbon dioxide emissions by 2050, which is in line with the ambitions of the Paris Agreement to keep the global temperature increase below 1.5°C.



We implement wide-ranging measures to minimize the negative impact of our operations on the climate, and to drive positive change. The climate performance of our operations is already very high compared to the global average. This is due to, among other things, access to renewable energy, a high degree of electrification and operations with high productivity. Significant efforts will continue to be necessary in order to promote development, while at the same time meeting increased demand for base metals such as copper, nickel and zinc.

Reduced carbon dioxide emissions

Boliden is a leader within the production of metals with a low carbon footprint. Like many others in our industry though, we face a number of climate-related challenges. Our mines and smelters add to carbon dioxide emissions in various ways. For example, our mines consume fossil fuels, while smelting processes require a great deal of energy for heating and the separation of metals.

In order to reduce the negative impact of our operations and drive positive change, we are focusing our efforts on areas where they will have the greatest impact. Among other measures, investments in increased electrification and energy efficiency are being made on a regular basis to further reduce our carbon dioxide emissions.

Read more about electrification at our mines on pages 18-21.

Climate strategy program

Boliden's climate strategy program summarizes how we manage climate-related risks and opportunities. It describes our approach and the steps we are taking towards decarbonization. Decarbonization reduces the risks associated with climate change. At the same time, it strengthens our competitiveness and long-term profitability, with the aim being to modify our production as quickly as possible to meet market demand.



Read more about Boliden's climate strategy program and climate work here

BOLIDEN'S CLIMATE TARGETS

We have set ambitious targets to reduce our climate impact.

40%

40% reduction in carbon dioxide emissions in Scope 1 and 2 by 2030, with 2021 as the base year.

30%

30% reduction in carbon dioxide emissions in Scope 3 by 2030, with 2021 as the base year.

<1.5 tonnes

<1.5 tonnes CO₂/t Cu
The average for all our copper production must not exceed the limit value for Low-Carbon Copper.

<1.0 tonnes

<1.0 tonnes CO₂/t Zn
The average for all our zinc production must not exceed the limit value for Low-Carbon Zinc.

Statement on our product CO₂ footprint

The mining industry currently lacks a standardized measurement method for carbon dioxide emissions – we want to change that.

We believe transparency is the only way to deliver a sustainable and long-term mining and metals industry. We produce cradle-to-gate life cycle assessments for our main metals, without including carbon credits and offsets. This makes it easier for us to see in which scope we need to make efforts to reduce our carbon footprint.



Scan the QR code to read more and to watch the film



Biodiversity and reclamation

Our operations require land and affect other stakeholders in these areas. A topic that requires particular consideration is biodiversity. For that reason, reclamation work and restoration of nature are a core part of what we do.

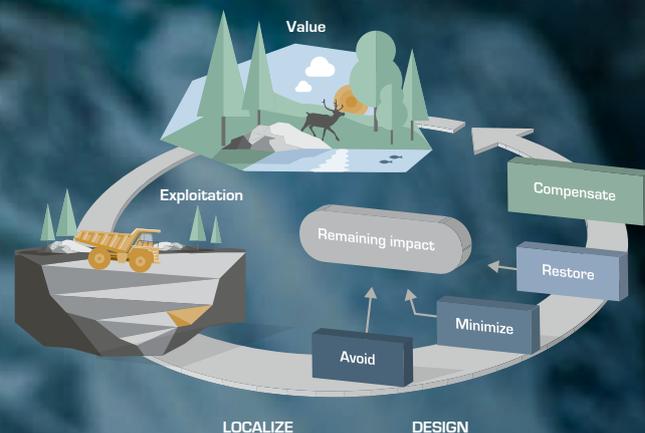
BOLIDEN SHALL...

- strive for continuous improvements in environmental performance linked to water management, energy use and climate change in order to be able to return the land to other land uses
- restore the land in a way that contributes to increased biodiversity and takes local interests into account.

BOLIDEN WORKS TO...

- in the first instance, avoid impact on biodiversity as far as is reasonable and possible
- secondly, minimize our impact on biodiversity
- thirdly, restore all land that has been impacted, largely with the aim of increasing biodiversity values
- as a final step, compensate for any impact on biodiversity by increasing or creating natural values in the local area.

We should make every effort to ensure that sites become a natural part of their surroundings once more.



Boliden is just one of the many stakeholders for land use in the locations where we operate. Protecting and promoting biodiversity is a prerequisite for all life on Earth, making it something that concerns us all. Boliden has contributed to the development of the Swedish mining and mineral industry's joint roadmap for increased biodiversity. The target is to contribute to increased biodiversity in all the regions where mining and mineral operations and exploration take place by no later than 2030.

Reclamation

Responsibility for the land we use extends well beyond the life of the mine. When the time comes to close a mine, it is also our job to restore and return the site. This means that we should make every effort to ensure

that sites become a natural part of their surroundings once more. As all our mining areas are different, we create a tailored reclamation program based on the most appropriate methods for the site in question.

Boliden currently owns and manages 70 or so decommissioned objects and has five operational mining areas. There are long-term reclamation plans in place for all of these. We work actively and systematically on both supervision and risk analyses for each area. During the operational phase, Boliden strives for responsible management of extraction waste, which includes preventing its creation and reducing its environmental impact. The goal is always to use the best available technology to manage the extraction waste and to reclaim, restore and eventually return any land we have used.

As early as the planning stage, the process of reclamation for a mine is described in a reclamation plan. Among other things, the nature of the waste, the appearance of the area, infiltration, watercourses or groundwater levels impact the choice of method. In order to implement new global guidelines, work is undertaken to ensure that each mine also has a plan for how the reclamation will be achieved. The aim is to restore the area so that it can become part of the surrounding landscape once more and be used for other purposes, such as reindeer husbandry or biodiversity.



Fish stocking supports biodiversity a

Companies at Kokkola’s large industrial park have been stocking the maritime area beyond Boliden Kokkola’s zinc smelter with fish for decades. Every year they release around 2 million fish. Stocking fish compensates for any harm caused and supports biodiversity.

Companies in the KIP area (Kokkola Industrial Park) stock fish under the mandatory restocking required by environmental permits, and there are also voluntary releases. Two million hatchlings are released in the Kokkola maritime area every year: whitefish, sea trout and burbot.

The hatchlings are transported to Kokkola from fish farms in Isojoki, Taivalkoski and Pyhäjoki. The fish are always released in the spring.

Ecological compensation

Fish stocking is ecological compensation for the harm caused to fish stocks by

industrial activities and shipping. In addition to the obligation to release fish included in environmental permits, companies in the KIP area make voluntary releases to extend the ecological compensation for harm to a broader level, i.e. to improve conditions in the environment. Supporting diversity and vitality in the fish population not only benefits the environment, but also professional and recreational fishing in the area.

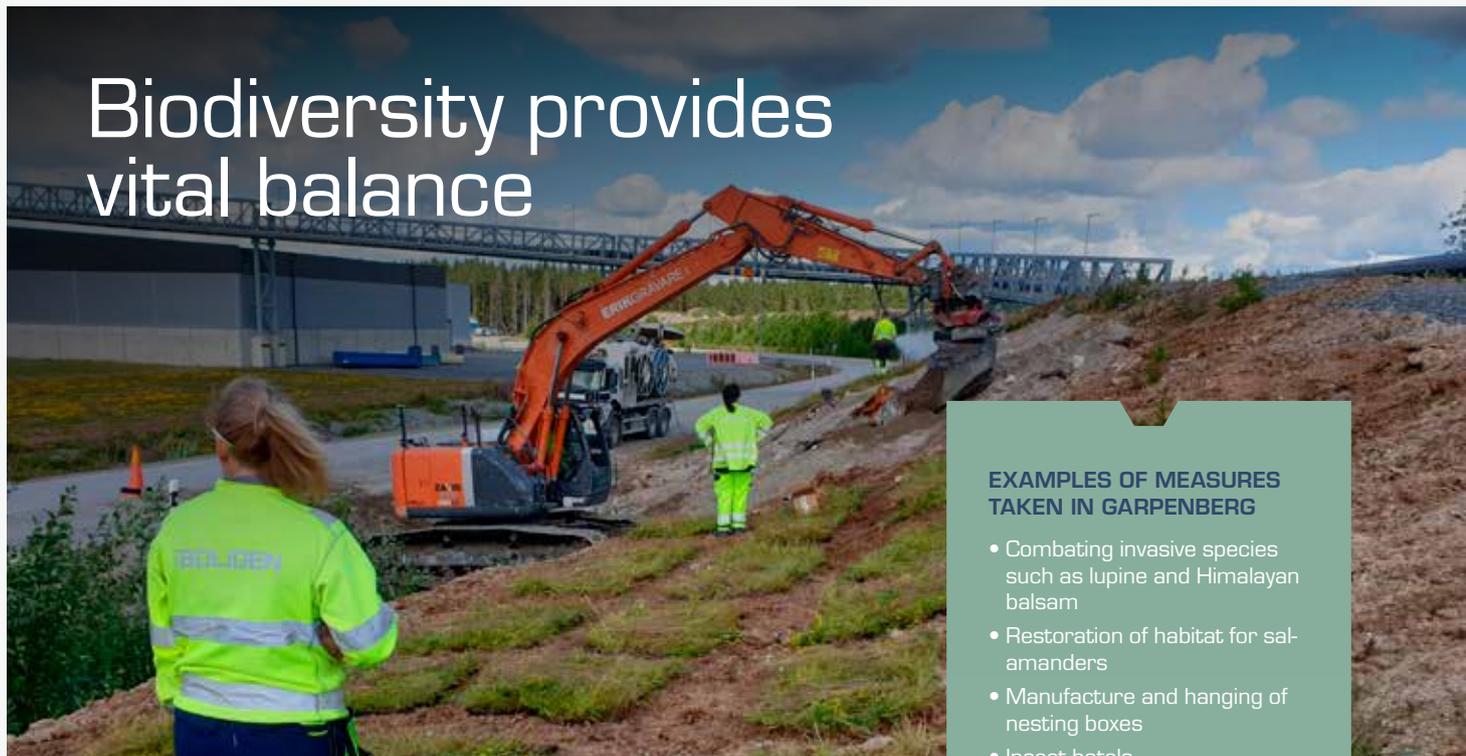
Fish stocking and other ecological methods of compensation are mechanisms for reconciling the interests of business and the environment.

However, the most important aspects for

diversity in marine and other ecosystems include avoiding and reducing environmental harm, which in Kokkola means, for instance, stable process operation, thorough waste water treatment and minimizing discharges into the sea.

We have been very successful in these areas. For example, in 2021 Kokkola’s discharges into the sea fell below all applicable monthly and annual emission limits.

Discharges of waste water into the sea are monitored from an observation point at the discharge site. Under the terms of the environmental permit, Boliden is responsible for all waste water released



Biodiversity provides vital balance

EXAMPLES OF MEASURES TAKEN IN GARPENBERG

- Combating invasive species such as lupine and Himalayan balsam
- Restoration of habitat for salamanders
- Manufacture and hanging of nesting boxes
- Insect hotels
- Frog hotels

Construction of insect hotels on the noise barrier surrounding the Garpenberg industrial area.

t sea

from the point of discharge into the sea, so the discharge figures also include discharges by the companies Umicore and Jervois.

More zinc from River Perho than industry

As regards emissions, the industrial situation has been stable for some time, which can be seen in a monitoring report published by the water protection association Pohjanmaan vesi ja ympäristö ry in the spring of 2021.

According to the report, one-and-a-half times more zinc enters the sea in water

from the River Perho, which flows past Kokkola, compared with the industrial waste water load. The difference is actually even greater, as a large part of the zinc load from industry comes from seawater used as coolant, the report shows.

The zinc discharges from River Perho are partly due to the area's acidic sulfide soil, from which zinc and other metals leach into the water.

In accordance with the obligation to stock fish included in the environmental permit, sea trout and whitefish are released in the maritime area outside Kokkola. The fish species released voluntarily are whitefish and burbot.



Biodiversity – an increasingly visible and popular concept in sustainability contexts. What is biodiversity about and how is it related to climate change?

The simple truth is that biodiversity is a prerequisite for all life on Earth. Functioning ecosystems protect against disasters and provide for healthy seas, plant pollination and a stable climate. The consequences of biodiversity loss are far-reaching, from exacerbating climate change and affecting food supplies to putting people and communities at risk, economically as well as fundamentally in terms of habitat and health.

Many experts say that the biodiversity crisis poses a greater threat than climate change and that addressing climate change hinges on addressing biodiversity, which means there is a strong motivation for industries and businesses to make contributions towards biodiversity in the same way as for climate goals.

In 2020 the World Economic Forum

(WEF) estimated that over half of the world's GDP is moderately or highly dependent on nature according to its New Nature Economy Report. "Businesses are more dependent on nature than previously thought, with approximately \$44 trillion of economic value generation moderately or highly dependent on nature," it says.

Cooperation and responsibility – the industry's contribution

In the same year the European Commission presented its Biodiversity Strategy for 2030 and the review of the UN Convention on Biological Diversity (CBD), and since November 2020, the Swedish mining and mineral industry has been working together as an industry to contribute to increased biodiversity by 2030. It is through this roadmap 'Mining

with Nature' that the industry has taken an important step in setting goals and proposing industry-wide working methods and solutions.

However, the work to reduce the impact on biodiversity, and contribute to increased biodiversity values, is nothing new for the industry. At Boliden, our goal is to contribute to increased biodiversity by 2030 in all regions where we operate. In Garpenberg, for example, we carry out systematic work to increase biodiversity.



Read more about our work with biodiversity:

Products with a lower carbon footprint

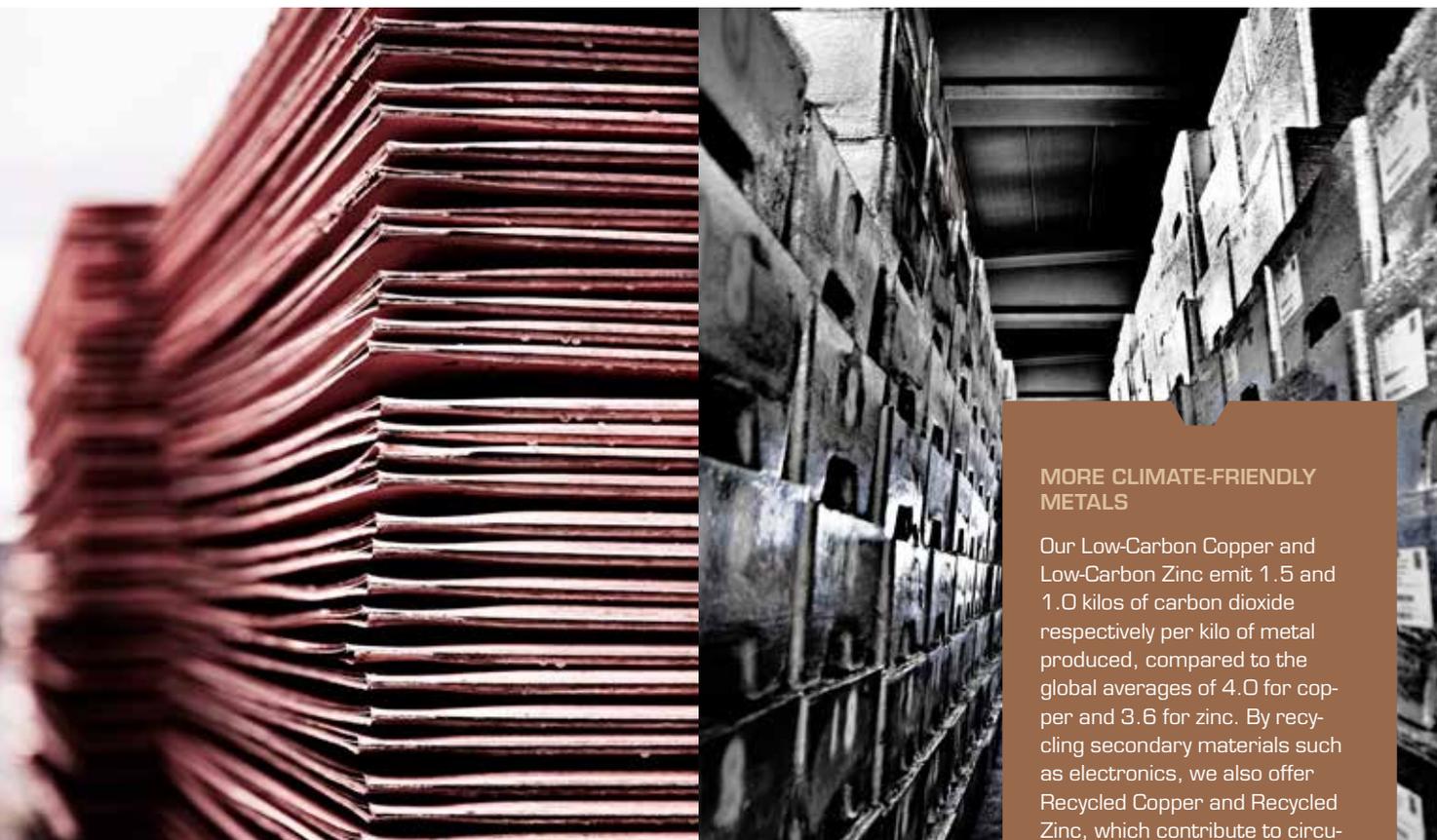


At Boliden we are proud to be able to offer our customers metals with a lower carbon footprint.

Our Low-Carbon Copper and Low-Carbon Zinc products are produced using raw materials from our own mines where we use fossil-free electricity. This means that they have among the lowest carbon footprints in the world compared to the global industry average. The Recycled Copper and Recycled Zinc products use, among other things, recycled electronics, copper scrap and dust from steel mills as their primary raw materials. By efficiently utilizing the metals already present in society, we can minimize the need for new mines.

In producing these metals, we constantly challenge ourselves to find new ways of reducing our emissions, and this in turn helps our customers to reduce the total emissions of products that use our metals. We are working hard on this and will soon be able to offer greater volumes and more metals with the same ambitious performance.

“...our low-carbon copper product can help reduce the wind farm’s carbon footprint.”



MORE CLIMATE-FRIENDLY METALS

Our Low-Carbon Copper and Low-Carbon Zinc emit 1.5 and 1.0 kilos of carbon dioxide respectively per kilo of metal produced, compared to the global averages of 4.0 for copper and 3.6 for zinc. By recycling secondary materials such as electronics, we also offer Recycled Copper and Recycled Zinc, which contribute to circularity in the use of metals.



PHOTO: DOGGER BANK

Boliden reduces the carbon footprint of The world's largest offshore wind farm

The world's largest offshore wind farm, Dogger Bank, has chosen to use Low-Carbon Copper from Boliden in the high-voltage offshore export cable systems for the third phase of the project, Dogger Bank C.

By using Low-Carbon Copper, the carbon footprint of this part of the wind farm will be reduced by more than 23,000 tonnes of CO₂, as it has less than half of the carbon footprint of standard copper.

Low-Carbon Copper from Boliden has a carbon footprint of less than 1.5 kg CO₂ per kg copper, which is significantly lower than the global average of 4.1 kg CO₂ per kg copper. This is mainly achieved by Boliden having access to fossil-free electricity, electrification of production and industry-leading productivity.

"We are happy to be part of this collaboration, enhancing sustainability in the value chain. This project is an excellent demonstration of what Boliden can offer in terms of sustainable base metals. We are delighted that our Low-Carbon Copper brings benefits to the project by reducing the footprint of the wind farm itself," says Daniel Peltonen, President Boliden Smelters.

Initially, the copper comes from ore mining in Aitik, Gällivare, one of Europe's largest and most productive open-pit copper mines with a high degree of electrification. The copper cathodes are then produced in Rönnskär in Skellefteå and delivered by rail to Elcowire, northern Europe's leading provider of copper solutions, which produces copper rods. The copper rods are then delivered to NKT in Karlskrona, who are pioneers in the cable industry and responsible for supplying cables to the Dogger Bank offshore wind farm.

GO ELECTRIC WITH COPPER

Copper is best known for its ability to generate, distribute and store energy. That is why it is often used in everything from cables, generators and switchgear to the light switches in your home. But copper has a number of properties that make it useful in many more contexts. Because it is antimicrobial, it is sometimes used on handles in public spaces, or in the Swedish one krona coin.

Boliden can produce the very pure copper suitable for superconductors. In fact, Boliden's copper is used in the CERN particle accelerator where the Higgs boson was discovered.

1 km

Total length of copper wire in an average family car

65%

Percentage of copper used to produce and conduct electricity*

99.9%

Almost all bacteria that end up on a copper surface die within two hours due to its electronic charge



CERN

Boliden's copper is used in the CERN particle accelerator where the Higgs boson was discovered

2.5 tonnes

Amount of copper per kilometer of high-speed rail track

2050

Global copper demand could increase by around 188%** by 2050



With Green Zinc Odda 4.0, the smelter becomes:

Major zinc and zinc alloy p

Boliden is now expanding the world's most climate-efficient zinc smelter in Odda. A historic investment for both Boliden and Norway.

The expansion enables Odda to almost double zinc production and at the same time reduce carbon dioxide intensity by 15 percent from an already world-leading position.

Boliden Odda has an annual production capacity for zinc of 200 ktonnes. The operation will be supplied with fossil-free electricity, and waste will be deposited in rock caverns using unique, sustainable technology. In addition to zinc, it will also be possible to extract the bi-metals lead, gold and silver. The increased production capacity together with improved energy efficiency and a new, long-term contract for the supply of fossil-free electricity means a further reduction in the already low carbon dioxide intensity.

Most of Odda's facilities will be expanded and Odda will also modernize its processes and invest in increased digitalization and automation. Odda's unique waste management solution will also be expanded.



roducer

On account of this significant technological development, Odda has been granted investment aid by Enova in Norway and Innovasjon Norge.

Odda will also be able to offer more zinc that can be used in buildings, infrastructure and the automotive industry in the most climate-efficient and sustainable way possible.

This is one of the biggest investments in Boliden's history. By increasing the production of zinc with the highest climate performance while also improving resource efficiency and productivity, we are setting a new standard for zinc smelting both in terms of sustainability performance and cost effectiveness.

VERSATILE ZINC

Zinc is a versatile metal with a wide range of important applications, each one different to the next. Much of global production is used to protect steel from corrosion in a process known as galvanization, which can extend the life of steel by many years.

Zinc is also an essential mineral used in everything from pharmaceuticals and sun cream to food supplements. It can also be used to improve harvests in low-nutrient soils, giving more people secure access to food.

17%

Used in the production of brass and bronze*

>20 years

Zinc can increase the lifetime of new wind turbines by at least 20 years

16%

Percentage of global zinc production used in other manufacturing, such as solar cells, pharmaceuticals and fertilizers*

50%

Half of the world's zinc is used for galvanizing steel*

50 kg

Amount of zinc in the average house



17%

Percentage of zinc used for die-cast zinc products such as zippers*

In 2022, zinc was added to the U.S. Geological Survey's (USGS) list of critical minerals.

2050

Global demand for zinc could increase by around 60%** by 2050

Boliden Rönnskär has an innovative and long-term solution for storing process waste. Nowhere else in the world is such a deep underground repository located so close to a smelter. This is where all process waste from the smelter will be stored indefinitely.



The underground repository

– a unique facility below the smelter

Rönnskär in Skelleftehamn is one of the world's most efficient copper smelters and a world leader in recycling electronics.

The underground repository will increase Boliden Rönnskär's flexibility to receive and process complex raw materials. At the same time, a long-term sustainable solution is created for waste management at the smelter.

A total of 330 meters below this industrial site, Boliden has constructed a deep underground repository for process waste. The location was chosen because of the properties of the bedrock, and to minimize transportation.

Environmental legislation focuses on mercury; if the waste contains more than 0.1% mercury, it must be stored in a deep underground repository. However, only a small part of Rönnskär's waste contains mercury – instead the majority is comprised of residues containing other substances, which are currently stored on the industrial site. In line with the Group's values, Boliden made the decision to place all process waste from the smelter in the repository, together with waste generated by day-to-day operations.

The depositing of waste began in February 2022. The repository consists

of a 3-km-long ramp and storage rooms accessed via a connecting corridor. A stabilization plant pretreats certain waste materials before they are placed in the repository. Stabilization should minimize the risk of leakage.

Depending on the type of waste involved, a deposit can be made from ground level or via a raised ramp in the storage rooms. Once a room is full, it will be sealed permanently. The facility also contains a vehicle wash for the vehicles that transport the waste. The wash water is treated at a separate water treatment plant.



Waste began to be deposited in the underground repository at Rönnskär in February 2022.

FUN FACTS

- In 2019, a race was organized for Rönnskär's employees, which involved running up and down the 3-km-long ramp. The fastest time was 28 minutes.
- By the time the underground repository is complete, more than 824,000 tonnes of rock will have been removed.
- The development of an underground repository has required expertise in geology, law, logistics, hydrogeology, rock mechanics, waste management, planning and design, geochemistry and environmental permits, among other fields.



How much process waste can the underground repository hold?

The volume of the underground repository will be about 300,000 m³. There are environmental permits to store 13 types of process waste, both waste that is generated by current operations and waste held in storage at Rönnskär.

How long is the repository expected to last?

The repository should last forever and should even be able to withstand another ice age! The reason for legislation on underground repositories for this waste is to ensure that storage is safe from a long-term perspective.

Is there a risk of leakage?

Studies by independent consultants have shown that there is very little risk of hazardous substances leaking from the repository. Storage deep in the bedrock is significantly safer than final surface storage in a so-called surface landfill.

What happens when it's full?

The eight storage rooms are expected to be filled by 2029. When they are full, the construction of additional rooms will probably take place. When it is no longer possible to expand the underground repository, it will be sealed with permanent plugs designed to prevent water from leaking out.

An engine for societal development

Yesterday, today and tomorrow

For almost 100 years, communities have evolved with us, and undoubtedly we with them. We have an important responsibility for many people's everyday lives. It is an opportunity and a trust that we are both grateful for and proud of.

A prosperous local community is fundamental to the long-term success of our operations. In many of the locations where we operate, we are a very significant employer. As such, we are committed to societal development and strive to contribute to both economic and social development. This means that we are involved in local organizations and participate in a variety of activities that benefit the region and its inhabitants. Our greatest positive impact is probably the tax revenues generated, both directly and indirectly.

A significant part of the areas where Boliden operates are located in areas where the Sami and reindeer husbandry have special rights. Access to land is of crucial importance for both mining and reindeer husbandry. Boliden works to involve potentially affected indigenous people early on, with the goal of promoting respect for the rights, interests, ambitions, culture and natural resource-based livelihoods of indigenous peoples.

11,500 SEK M

Our most recent calculation estimates that direct and indirect tax payments in Sweden, Finland, Norway and Ireland amount to a total of SEK 11,500 m.

Read more about indigenous peoples and communities



25,000

For each Boliden employee, an average of four more jobs are created in connection with the operations. Currently, approx. 25,000 jobs are created as a direct and indirect result of Boliden's operations. Similarly, profits are created for public finances.



Boliden is investing SEK 2 billion to expand the Kristineberg mine, specifically mining of the Rävliiden deposit. Because we are aiming for a fossil-free mine, modernization and new technology are essential.

The electrified mine of the future in Kristineberg is taking shape

The investment is warmly welcomed by both Peter Bergman, General Manager for the Boliden Area, and Erik Fjällström, Mine Manager at Kristineberg.

“It means we’ll have the opportunity to build a new operation and expand Kristineberg using new technology. Being able to expand production while leaving the absolute smallest footprint possible makes this a very interesting project,” says Erik.

Gradual transition to fossil-free operations

In general, mining operations have a high carbon footprint, and although Boliden has a lower footprint than the industry as a whole, our ambition in this project is to be fossil-free underground.

“We’re taking these steps to make us the most climate-friendly metal producer in the world. That’s the vision we’re working

towards. In purely practical terms, this means, for example, eliminating carbon dioxide emissions from loading and transport, which account for 80 percent of total CO₂ emissions. But of course, we’ll still have the old haulage equipment until we have to buy new, so we’ll be moving gradually towards a fossil-free mine; it won’t happen overnight,” explains Peter.

Extending the lifespan of the Boliden Area

The investment can be described as a major boost for both Kristineberg and the Boliden Area, and a way to safeguard the existing organization.

“Adding this tonnage means we can make full use of the plant’s capacity, which currently has a shortage of ore. What’s more, it extends the lifespan of the entire Boliden Area, and gives us the opportunity to continue exploration and extend

ore supply. We like to view it as a means of safeguarding the jobs we have, and it enables us to familiarize ourselves gradually with use of the new technology,” says Peter.

“This means a great deal to me as a person from the inland North, and it’s a boost for the whole area. Being able to live and work in the area, having jobs up here and working with all this new technology is a big deal. The technology may well create exciting jobs and perhaps encourage people to remain in the area,” says Erik.

The environmental permit was granted in the summer of 2022 and the project is now being implemented.



ERIK FJÄLLSTRÖM
Mine Manager,
Kristineberg



RÄVLIDEN

Rävliiden is a deposit near the Kristineberg mine in the Boliden Area.

Here, Boliden is building a 5.6-kilometer-long track along which electrically powered trucks will transport ore from Rävliiden to the mine in Kristineberg.

Electrifying the Kristineberg mine means that we are decarbonizing loading and transport, which account for about 80 percent of the total carbon dioxide emissions.



How electrification helps Boliden create fossil-free mines.

Electrification of heavy machinery for loading and transport

An important area of focus is to electrify heavy machinery for loading and transport. This machinery accounts for about 80 percent of a mine's carbon dioxide emissions.

But what does 80 percent of a mine's emissions actually mean? Well, in Rävliiden's case about 1.8 million liters of diesel. Every year. In addition, there will be an indirect reduction in the tankers that will no longer need to deliver diesel to the Kristineberg mine.

"This is a really big step for us in the Boliden Area, and our focus will be on what has the most impact. But it's important to remember that we won't become fossil-free overnight. We will be working to gradually eliminate emissions," says Peter Bergman, General Manager for the Boliden Area.

Mining and construction machinery will also be electrified. In practice, this

will involve electric vehicles and mobile machinery, charging infrastructure and an electric trolley track.

Improved work environment

The investment in fossil-free operations will not only benefit our climate. It will also improve the work environment for employees. That's because exposure to noise, vibrations and exhaust gas emissions will be reduced.

Support from the Swedish Energy Agency corresponds to approximately 40 percent of the additional cost involved in electrification.

The environmental permit was granted in the summer of 2022.



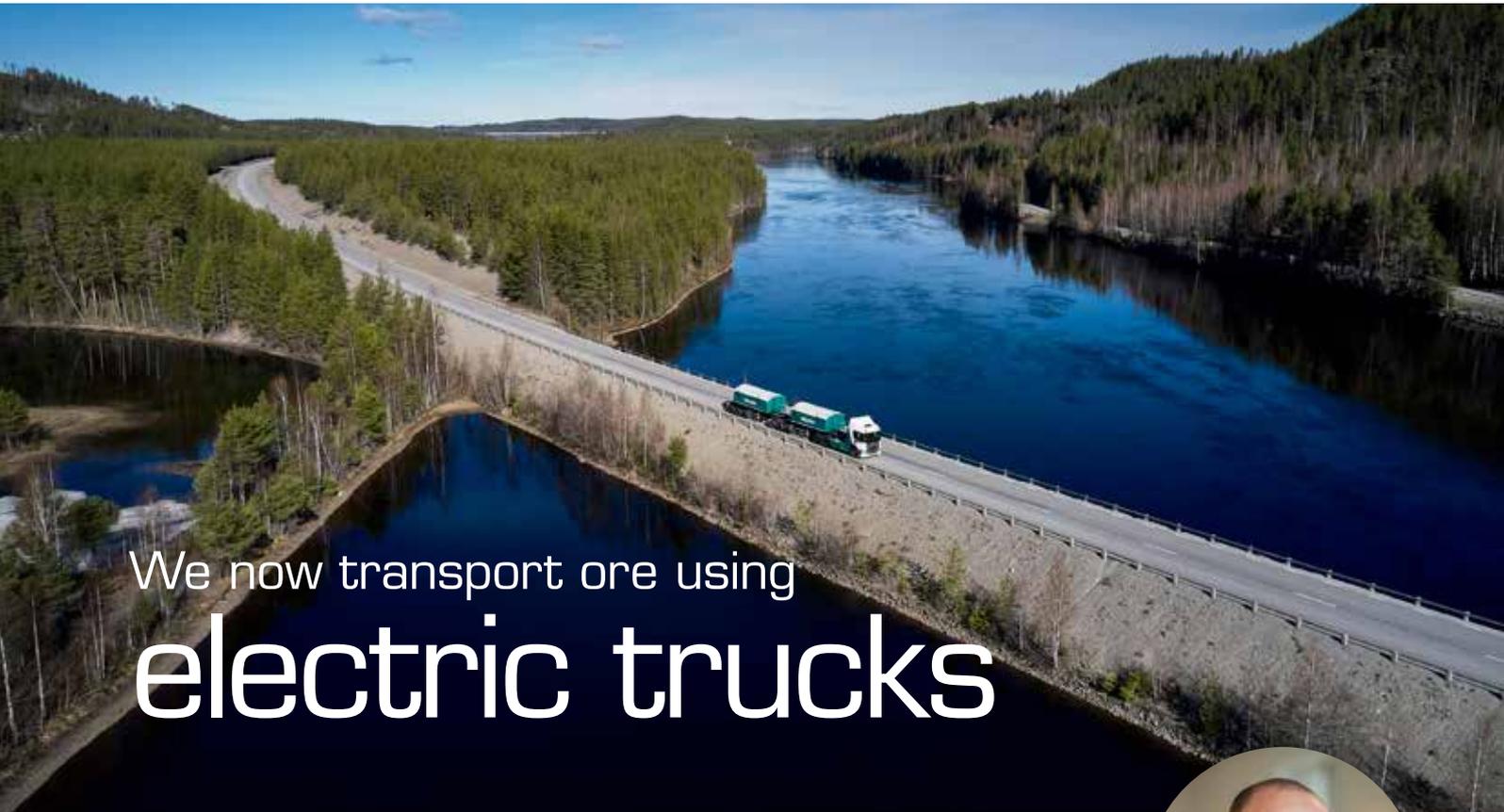
Watch the film



Peter Bergman, General Manager for the Boliden Area.



The new electric truck supplied by Scania will operate between Renström and the concentrator in Boliden. This is the first step in efforts to electrify heavy transports on public roads between mine, concentrator and smelter.



We now transport ore using electric trucks

The electric truck began operating on the roads in the second quarter of 2022. It transports ore between the Renström mine and the concentrator in Boliden.

“This is really a preparatory measure. You could say that we are paving the way for the electrification of all trucks that transport our ore and concentrate,” explains Jonas Ranggård, Program Manager Electrification, Boliden Mines.

Boliden, in partnership with Renfors Åkeri, which is responsible for transports, will test and evaluate the truck over a period of three years.

Subsequent ambitions include electrifying the remaining transport activities on public roads as soon as technology allows. In par-

allel, we are conducting studies on charging infrastructure to enable the operation of a fully electrified fleet of vehicles.

“Early involvement in and testing of electric vehicles for very heavy transport, and input into the development of and transition to sustainable solutions is wholly in line with our vision,” says Jonas.

The project is part of REEL, Regional Electrified Logistics, an initiative led by CLOSER and supported by the Strategic Vehicle Research and Innovation (FFI) program, which aims to pave the way for the transition to an electrified freight transport system on the Swedish market.



JONAS RANGGÅRD
Program Manager
Electrification, Boliden Mines

Climate-smart transport

Boliden is investing SEK 300 million in the expansion of electrified transports at the two open-pit mines in Aitik and Kevitsa.

The starting shot for electrified transport was the launch of a pilot project in Aitik. This was followed by a similar project in Kevitsa, which began in September 2022. At Aitik, which is the world's most efficient open-pit copper mine, the installation of a 700-meter-long electric trolley track and the conversion of four mining trucks has resulted in increased productivity and reduced diesel consumption. Aitik was the first mine in the Arctic climate to have an electric trolley track installed.

Another three kilometers of track are being built in Aitik, and ten more trucks are being converted to electric power. Overall, the system will be able to reduce greenhouse gas emissions from transportation over the lifespan of the mine by 15 percent.

In Kevitsa, 13 mining trucks are being converted to run on electricity, at the same time as a 1.8-kilometer-long electric trolley track is being built. The investment will enable greenhouse gas emissions over the lifespan of the mine to be reduced by 9 percent. The Kevitsa open-pit mine is located in one of Finland's largest mineral deposit areas.

It is estimated that Boliden will reduce diesel consumption by 5,500 cubic meters per year by the time the investment is completed. In addition, there will be productivity gains, as the electrically powered trucks can operate at a much higher speed. The work environment for drivers will also be improved, in part thanks to lower noise levels and reduced need for maintenance.

Electric mining trucks have been around for some time – trials were carried out back in the 1980s in South Africa, for instance, but together the number of mines around the world that use the technology can be counted on the fingers of one hand, and Boliden is one of them.

Some results from Aitik's pilot project:

- An increase in speed from 15 to 30 km/h means it is possible to travel the 700-meter stretch 70 seconds faster per trip compared to a conventional mining truck.
- Diesel saving, 25 liters per 700-meter trip.
- A saving of 830 cubic meters of diesel per year at Aitik. Maximum line expansion at Aitik is expected to reduce diesel consumption by 20-50%.
- The trucks need less maintenance.
- Significant international interest, with many inquiries about the project from other parts of the world.
- The pilot project has received support from the Swedish Energy Agency and is being implemented with a number of partners, including ABB and Eitech for the electrical infrastructure, and Caterpillar and Pon Equipment for the truck conversion.
- A fun piece of trivia – the overhead lines that provide electric power to the trucks are mainly made from copper mined at Aitik.

ELECTRIFIED TRANSPORT IN FIGURES

27

27 mining trucks.

5,500 m³

5,500 m³ reduction in diesel consumption.

70_{sec}

70 seconds faster than a diesel truck over 700 meters.





In search of new mineral deposits

Geologists, geophysicists and technicians at Boliden are constantly looking for valuable mineral deposits near our mines and in new locations.

Looking for new mineral deposits or ‘exploration’ is the foundation for Boliden’s operations and a prerequisite for being able to produce and sell metals. The work is carried out by geologists, geophysicists and technicians, who take measurements and conduct surveys out in the field, as well as analyze the information collected. The objective is to identify deposits that contain enough metal to make them worth mining. Such deposits are classed as ore, which is thus an economic term.

“Society is dependent on, for example, copper, nickel and zinc for batteries and electrification, communication and societal development. All mines have a limited life, so to safeguard production at Boliden and to meet demand both in the Nordic region and elsewhere in the world, we have to identify new workable mineralizations,” explains Jonas Wiik, Boliden’s Exploration Director.

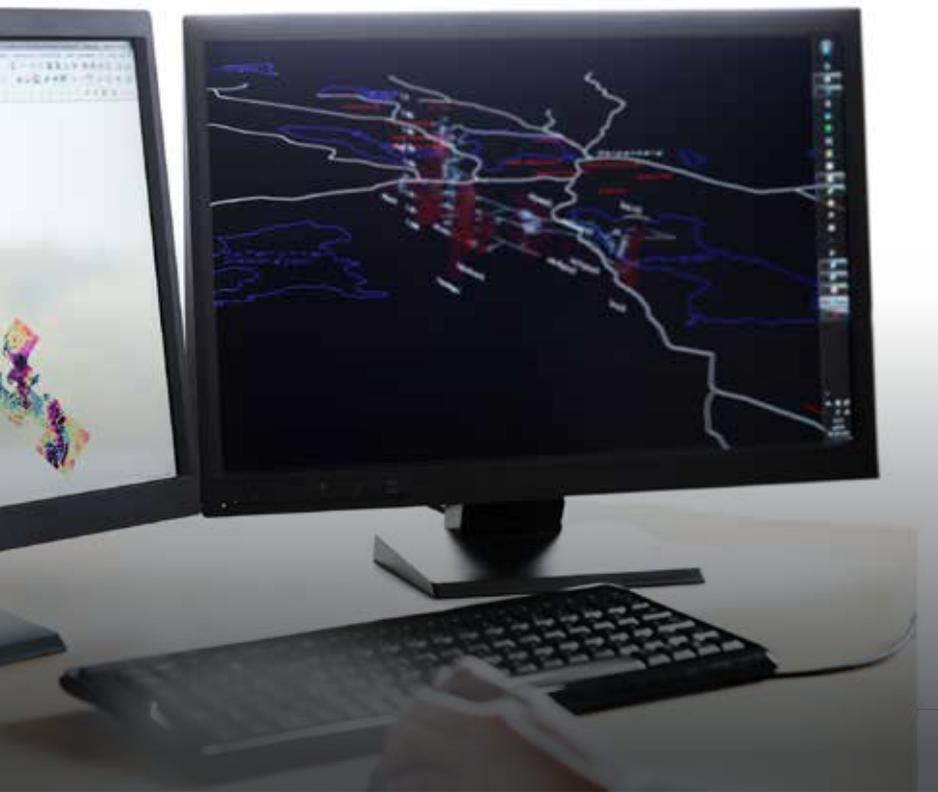
In Boliden’s case, this means first finding minerals that contain copper, nickel and zinc, although lead and precious metals are also of interest to the company. There are numerous different exploration methods

used to find mineralizations, including, for example, boulder hunting, geological mapping, geophysical surveys, geochemical sampling and sample drilling. All data collected using the various methods is processed and interpreted before the next phase of survey work gets underway. Data is stored in various databases as a way of providing a secure long-term storage environment and enabling good access to data for use in various modeling programs. Modeling uses data from all elements of the process, such as geochemical, geological and geophysical data.

A lengthy process

All this provides a basis for decision-making about whether or not to continue with more sample drilling, prior to carrying out concept and preliminary studies, and eventually commencing mining. The path from discovery to mine is a long one, and it often takes many years from the initial surveys until a new mine comes into production.

“We want to know whether there is mineralization in the bedrock, what sort



Boliden's exploration strategy is to ensure that all mining areas have an ore base that enables at least 15 years of production planning, but also to work to enable organic growth of the mining areas.

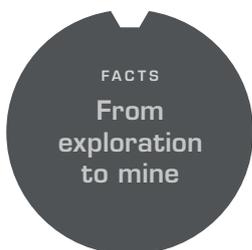
conducts international exploration, where the company collaborates with business partners already operating in various regions to identify new projects that can be developed together. Current focus areas are Europe and North and South America. Boliden conducts its own near-mine and field exploration in Sweden, Finland and Ireland. Work continues all year round, and each exploration project is managed by a group of experts who produce work plans and ensure that work is conducted safely and in accordance with applicable rules and legislation. The group also engages in close dialogue with various authorities, such as the Mining Inspectorate of Sweden (Bergsstaten), that issue permits for exploration activities on someone else's land, and other interested parties.

Positive dialogue

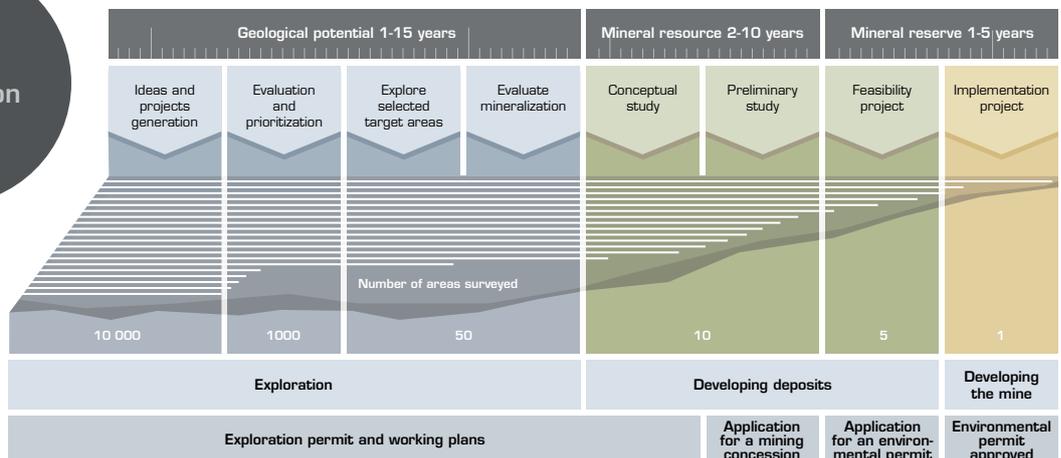
“It is extremely important that we have a positive dialogue with the authorities, landowners and other interested parties, who may include forest owners, reindeer herders and homeowners. It is vital that we exercise the utmost caution when it comes to our environmental responsibility and that we always do our share. Our objective is to leave the area in the same condition or better than before we started our exploration activities,” says Jonas.

of mineralization it is, where and how it is positioned, the volume and the actual metal content. Boliden's exploration strategy is to ensure that all mining areas have an ore base that enables at least 15 years of production planning, but also to work to enable organic growth of the mining areas. We also survey areas further from our existing mines that have the potential to

become new mining areas,” says Jonas. There are two types of exploration at Boliden. Near-mine exploration takes place close to existing operational mines, while field exploration is conducted in brand new areas where it is thought that the bedrock may contain interesting mineralizations that may form the basis for new mining activities. Boliden also



Opening a mine is an extensive and expensive process, and having located an ore deposit, it can take many years before actual mining begins. There are countless interesting exploration finds that never get that far.



How a mine works

Boliden owns both open-pit mines and underground mines. The geometry and composition of the ore body determine how it is mined and which concentration processes are used.



Drilling

Drilling and blasting

When mining underground, ore is accessed by means of ramps and drifts. Holes are drilled into the ore that can measure between 45 and 100 mm in diameter and are 5-25 m deep. The holes are pumped full of an emulsion explosive. Each hole has an individual detonation delay, meaning there can be up to six seconds between the first and last detonation. One charge can produce between 500 and 20,000 tonnes of ore.

At the Aitik open-pit mine, the holes are 16-17 meters deep, and here a normal round produces approximately 700,000 tonnes of extracted rock.



Reinforcement

Loading

At a number of Boliden's underground mines the blasted ore is loaded with the aid of remote-controlled loaders. These can either be controlled entirely by an operator or operated automatically, with loading and unloading being performed remotely by an operator using a CCTV camera system, while transport is conducted automatically via a local WLAN system. At an open-pit mine, the ore is loaded onto mining trucks by excavators.

The ore is then transported to a crushing plant, which may be above or below ground.



Crushing

Reinforcement

Systematic safety work is performed in any area of the underground mine where people are working, which involves scaling, shotcreting and bolting. During scaling, loose rock is removed from the roof and walls using mechanical scalers. The rock surfaces are then sprayed with a layer of steel fiber-reinforced concrete.

Finally, rock bolts are drilled and cast in place in a systematic pattern.

Crushing

The mined ore is crushed into smaller pieces at the crushing plant before being transported first to an intermediate storage facility and then to the concentrator.

At an underground mine the crushed ore is carried up through a shaft to the surface using a rock hoist.

At an open-pit mine, the ore is carried by mining trucks up a spiral ramp.



Charging and blasting



Loading and transport



Grinding



Dewatering

Grinding

The valuable mineral is separated from waste rock at the concentrator. The first stage in this process involves adding water and grinding the ore in large mills. A popular method is autogenous grinding, which means that the ore grinds itself without the addition of external grinding media.

The end result is a slurry containing water and finely ground ore.



Flotation

The flotation process is a surface-chemical process, where small amounts of chemicals are used to affect the surface characteristics of valuable minerals, causing them to become hydrophobic. When air is blown into the slurry, the hydrophobic mineral particles adhere to the air bubbles and are carried up to the surface, where they can be removed in the form of a foam. The process is monitored by operators who can adjust a number of parameters, thereby maximizing the amount of extracted metal.

Dewatering and concentrate

The mineral is drained and filtered, producing a fine-grained concentrate, which is the mines' end product.

Boliden's mines produce mainly zinc, copper and lead concentrates, which are refined by various processes at smelters, resulting in pure metals. Precious metals are bound to these concentrates and are extracted at the smelters. Read more on page 16.



Flotation



Concentrate transport

Responsible forestry

Boliden owns a total of around 24,000 hectares of land, of which 14,000 hectares is forest. The biggest holdings are located around our active mines, Aitik, Garpenberg and the Boliden Area. We also own land around our old disused mines such as Saxberget, Vassbo and Enåsen.

Boliden manages its forest in compliance with the Forest Stewardship Council recommendations (FSC – an international non-profit organization that promotes responsible forestry). Ten percent of the forest we own is set aside for free growth, which means no logging takes place in these areas. Five percent of our forest is treated with special care for the benefit of various woodland species. The remaining area is managed conventionally and we fell around 8,500,000 board feet of lumber every year.

Boliden has also begun work on creating nature parks from our forest properties. The aim of the nature parks is to support biodiversity and increase natural values. Our first biodiversity park opens in Lauker, Norrbotten in the spring of 2023. The park contains high natural values and protected species that we are trying to support through forest management. We have introduced floating duck islands on a lake

on the property, set up nesting boxes and cleared away undergrowth. We will also create a 600-hectare nature park in Örebro county, in addition to the 250 hectares on the same property let as a nature reserve.

Five components of forestry

Forestry has five different components; first, we perform regeneration logging on old-growth forest. When we carry out regeneration logging, five percent of the trees are left for the benefit of nature conservation and biodiversity. After regeneration logging, we prepare the soil and create space for new seedlings. We plant at least two trees for each tree felled. After planting, the forest needs to be cleared of undergrowth when it's 10-20 years old. After clearing, there are one or two thinnings when the forest is between 40-60 years old. And at 80-120 years we come full circle as it's time for regeneration logging again.

We engage contractors to help us with forest management, and they carry out clearing, planting and controlled burning. Every year we spend SEK 1 million on clearing forest, and SEK 0.5 million on forest roads.

Boliden has forests very close to urban areas around the mining communities. Great emphasis is given to recreation and outdoor activities in these forests. We take care of school woodlands, illuminated trails, rest areas, barbecue pits and wind-breaks on our land.

Boliden's forest management department also purchases real property, primarily for the development of present and future mines.

The aim is to manage forests for future generations. Everyone should be able to enjoy leisure time and nurture their well-being in Boliden's forests.



We plant at least two trees for each tree felled.



“We need a sustainable solution that will remain effective even after mining has ceased.”

Making use of nature

Boliden Tara is one of the first mines in the world to successfully remove heavy metals from waste water.



Tara Mines is getting help from mother nature to treat mine waste water. Waste water management is a challenge that faces every mining operation. The environmental team at Boliden Tara in Ireland has been researching an alternative method that uses natural biological and chemical processes to remove dissolved metals, sulfates and other chemicals from the water. These processes require little or no chemicals and very little maintenance.

“We need a sustainable solution that will remain effective even after mining has ceased,” says Senior Environmental Engineer Oliver Fitzsimons at Boliden Tara.

The focus of the research has been an integrated constructed wetland (ICW). Integrated constructed wetlands are nothing new, but Tara was one of the first sites in the world to successfully remove heavy

metals while reducing sulfate and nitrogen concentrations.

“ICWs are similar to natural wetlands, but in a limited, monitored and controlled environment,” says Ailish McCabe, Environmental Engineer at Boliden Tara.

Wetlands flourishing

Wetland environments provide ideal conditions in which special ecosystems can develop.

Ailish explains that in this low oxygen environment, specially adapted microorganisms have to compete for the available oxygen and they must therefore ‘steal’ it from the sulfates and nitrates in the water, in order to survive and thrive.

Integrated constructed wetlands can do more than just treat water effectively. Over time, the wetlands flourish, attracting many new species, and eventually the area

becomes a natural, self-sustaining, biodiverse environment. Another area of great interest is the ability of wetlands to bind carbon.

Oliver explains that Boliden sees a potential in the ICW system to provide an efficient, sustainable water treatment solution that in time will grow into a valuable, biodiverse ecosystem, a carbon sink in its own right.

Next steps

The pilot project in Tara has been running for two and a half years.

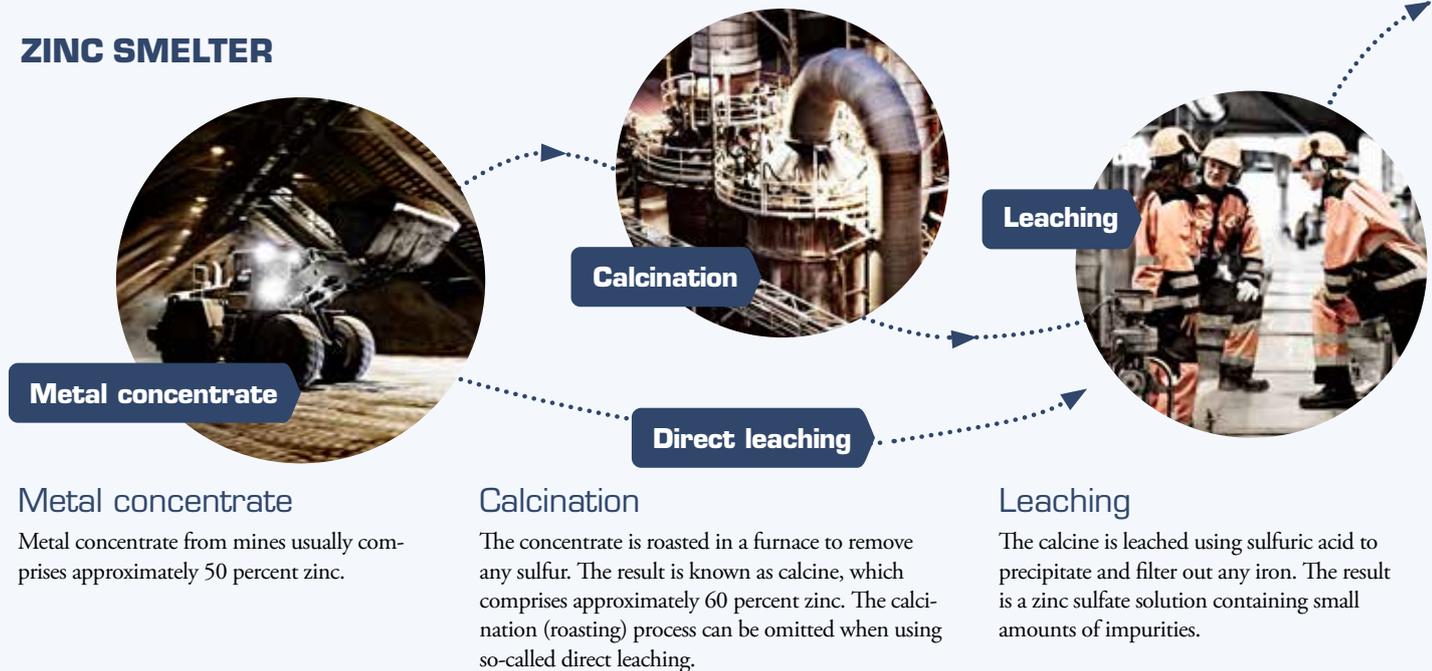
“We’re very happy and optimistic about the results so far,” says Oliver.

The next step will be to discuss the findings with the regulatory authorities and convince them that the system can be an effective short, medium and long-term water treatment alternative.

How a smelter works

Mine concentrates and secondary materials are refined at Boliden's smelters, producing pure metals. These metals are separated using reactions at high temperatures or with the aid of leaching.

ZINC SMELTER



COPPER SMELTER



Purification



Purification

The zinc sulfate solution is purified in three stages, after which it contains approximately 150 grams of zinc per liter.

Casting



Electrolytic refining



Electrolytic refining

The zinc is separated from the solution using the electrolytic refining process. The result is zinc cathodes with a zinc content of 99.995 percent.

Casting

The zinc is then cast into ingots or so-called jumbos, which can weigh up to four tonnes. The zinc can also be alloyed with other metals in line with customer requirements.

End product



End product

The majority of zinc is sold to steelworks, which use it to rustproof their own products. These products are then used in cars, bridges, high-rise buildings and wind turbines, for example.

Precious metals plant



Precious metals plant

Gold, silver, palladium and platinum are extracted during the process and make a substantial contribution to the revenues of copper smelters.

PHOTO: STEFAN BERG AND PÄIVI KARJALAINEN

Electrolytic refining



Electrolytic refining

The anodes are placed in tanks with steel cathode plates. In the subsequent electrolytic refining process, copper migrates from anodes to cathodes, which ultimately have a copper content of 99.9975 percent or higher. The cathodes are separated from the steel plates and washed. They are then ready for delivery.

End product



End product

The copper is sold mainly to wire rod and copper rod manufacturers and will eventually be used in the construction industry, for example, or in electrical and electronic products.

Anode casting

The blister copper is then processed in an anode furnace to reduce its oxygen content. This increases the purity level to 98-99 percent and the copper is then cast to form anodes.

5

QUICK QUESTIONS

HOW TO APPLY FOR A JOB AT BOLIDEN

Where can I find out about job vacancies?

All job vacancies within the Boliden Group are published on the website www.boliden.com under the Career tab. Click on the heading you are interested in for more information and contact details for the recruiter concerned.

We also use other channels, such as LinkedIn, and sometimes advertisements in the press.

How do I apply?

We can only accept applications submitted through the job advertisement's application function. It is therefore important that you submit your application via our website and that you submit separate applications for each position you are interested in.

The first time you apply for a job with us, you will need to create a profile, if you do not already have one. You can also edit or delete your profile if you no longer wish to keep it.

How will I know when a new advert is posted?

By creating job alerts, you will receive a targeted mail every time we publish a new advertisement that matches the criteria you have included in your job alert. It is possible to create multiple job alerts if you are interested in a number of different professional categories or sites.

What happens next?

Once you have submitted your application, you will receive confirmation that your application has been received. Once the application period has ended, the selection process begins, unless the advertisement states otherwise.

Once a suitable candidate has been chosen, we will notify all applicants.

How can I contact Boliden?

We can only accept applications submitted through the job advertisements on our website. You can always get in touch with the named contacts in the relevant advertisement if you have questions about the ongoing recruitment process.

 Find out more about Boliden on LinkedIn



FACTS
Grow with
Boliden

Drive change for generations to come

Boliden offers several types of training courses. New employees are inducted according to a structured process, and all employees receive the training they need to carry out their assignments safely, efficiently and skillfully.

Boliden has ongoing leadership programs for managers, with a focus on leadership and employee development. A number of statutory training courses are also arranged, as are courses in ethics and how to represent the employer in legal, labor legislation and personnel-related issues.

In order to provide employees with the opportunity to develop both personally and professionally, each employee has an individual development plan that is agreed in consultation with his or her manager. Because it is important for all employees to understand how the value chain is connected, we also arrange courses and study visits to our various units.

Boliden also has a number of group-wide programs and initiatives, such as the Boliden Academy Young Professionals Program and Women at Work.

Lund Cathedral is nearly 900 years old, and a maintenance and renovation project is now under way to ensure that it is able to stand for at least another 900 years. Boliden Bergsöe is recycling the roofing sheets.

High level recycling

As part of this work, a somewhat more obvious intervention is now underway. The cathedral's two towers are getting new roofing sheets. The existing towers were built between 1860 and 1880. They have been renovated several times over the years since then. The last time the sheet metal on the roof was replaced was between 1908 and 1911, when the work was actually carried out up on the roof.

It is now that time again. The old lead roofs on the two towers are to be replaced. This time, however, they will be lifted down and the work carried out on the ground, reflecting modern health and safety practices and using options that simply were not around 100 years ago.

The metal removed from the roofs will be recycled, and where better for the 110-year-old lead sheets to go than Boliden Bergsöe, just up the coast.

The first lead sheets have now arrived at Boliden Bergsöe. They closely resemble paper or cardboard and are almost as soft to bend. Imagine what the lead in these sheets could be used in next! Perhaps a battery for an electric car?



Boliden Bergsöe is recycling Lund Cathedral's roofing sheets.

ROLL WITH LEAD

Lead is one of the most recyclable metals. It can be recycled over and over again without losing any of its properties. The metal's properties make it suitable for energy storage and batteries.

Almost 90% of all lead is used in some kind of battery. It will not only provide important support for tomorrow's industrial batteries, for instance, but also electric vehicles where lead acid batteries will be used to power electronic equipment.

2050

Global demand for lead could increase by around 73%* * by 2050

50%

The amount of raw material from recycling

90%

Used in some form of battery*

70%

Percentage of lead produced in Bergsöe sold to the automotive industry

99%

Percentage of lead recycled in Europe



70%

Global rechargeable lead acid battery storage capacity

4 million

Number of car batteries recycled by Boliden every year

25 years

The average 25-year lifetime of an underwater cable can be doubled if it is protected with lead

* % of global production

** Forecast average. Source: Svemin 2021

If we are serious about making the green transition, we have to deal with the rapidly growing demand for minerals.

Europe must ensure security of supply of

CRITICAL MINERALS

“The European Commission and the European Parliament are pressing member states to develop measures that can ensure the supply of raw materials. It is high time that we made tangible efforts to move forward with this,” says Pekka Suomela, Executive Officer at the Finnish Mining Association (FinnMin).

The war launched by Russia has shown us how vulnerable the EU’s supply of raw materials really is. It has become more difficult to buy raw materials, while expected demand has increased significantly. It’s a challenging equation.

Replacing fossil fuels with electrical solutions, as well as the ongoing digitalization of society, has seen demand for a number of metals increase several times over. The EU consumes approximately 20 percent of the world’s minerals but produces just two percent.

No one expects Europe to be able to become completely self-sufficient in minerals. However, we have a number of opportunities to strengthen our domestic production. The mineral reserves in, for example, Finland’s bedrock are unique. There are 14 critical raw materials that can be extracted from Finnish mineral deposits that constitute important value-creating products.

Three stages of the mineral race

Commodity markets have changed in such a way that a number of countries are now being forced to rethink their mineral strategies. These strategies should include various measures that all pull in the same direction.

In many countries, it is necessary to speed up permit application processes.

“We will delay the green transition by

several years if even the smallest expansion investment requires a permit application process that takes years to complete, which is the case as things stand,” says Pekka Suomela.

It is also important to further improve skills and knowledge. It would also make sense to steer public development funds towards the development of sustainable processes in the mining industry. Europe has plenty to gain in return. It would safeguard societal functions, ensure the right conditions for both industry and jobs, reduce uncertainty for all parties, and improve knowledge of the mining industry.

“We undoubtedly need other measures beyond strengthening the mining industry. It is important to promote a circular economy and low-carbon industrial solutions,” concludes Pekka.



PEKKA SUOMELA
Executive Officer at the Finnish Mining Association, FinnMin.



CHARGE WITH NICKEL

Most of the world's nickel production is used in the manufacture of stainless steel. This is due to nickel's great ability to protect against corrosion, something that has also led to its use in aircraft jet engines, for instance. And because nickel also has good conductivity, it's an important metal for tomorrow's increasing production of electric vehicles.

Demand for the metal is expected to increase sharply in the years ahead due to its use in rechargeable batteries.

34%

Expected increase in nickel demand linked to climate technologies by 2050***

75%

Percentage of nickel used for the production of stainless steel*

Nickel is of great importance for technologies linked to alternative fuels for vehicles, among other products

In 2022, nickel was added to the U.S. Geological Survey's (USGS) list of critical minerals.



80%

In 2020, a standard battery consisted of around 80% nickel

7%

Percentage of nickel used for battery production*

2050

Global nickel demand could increase by around 212%** by 2050

* % of global production

** Forecast average. Source: Svemin 2021

*** Source BGS; Watari et al (2018, 2021); IEA (2021)

TOMORROW'S MINES WILL BE DIGITAL



In modern mines, work is increasingly carried out using autonomous machines and wireless networks. The benefits of this include increased production and a safer work environment.



Modern mines are becoming increasingly digitalized. Boliden is currently pursuing a globally unique venture to develop automation in its mines. This is taking place in a cross-functional program involving employees from various departments, as well as external parties such as Volvo, Ericsson, Epiroc and ABB. The long-term goal is to streamline mining, so that production can continue around the clock. Peter Burman, Program Manager Mine Automation at Boliden, explains:

“Today, there are clear peaks and troughs in the production flows of our mines. During shift changes, lunches and breaks, production drops significantly. With the help of better production con-

trol, productivity could increase by 10 to 20 percent. With autonomous machinery operating even when nobody is present in the mine, that figure increases to between 40 and 80 percent.”

It began with the network

The Boliden mine in Kristineberg has been in operation since 1940. In 2012, the mine was the first in the world to employ a combination of wireless networks, IP telephony and positioning. The network has 100 percent coverage over a total distance of 35 kilometers. Today, all communication takes place via the network. In the next phase, Boliden installed wireless networks in the Kankberg and Garpenberg



“The mine used to be like a black hole, but now we can see what is happening down there in real time.”

automation program have great potential for increasing productivity, the biggest gain is in safety. One example is 5G, the fifth generation of mobile networks, which has been tested in partnership with Ericsson at one of Boliden’s mines. The technology provides shorter response times and better remote control capabilities. Thus, the successful implementation of 5G should lead to a safer work environment.

“We will have access to technology that gives us greater scope to remove personnel from hazardous areas. Shorter response times are crucial as we prepare to make greater use of remote-controlled machines,” continues Peter.

Another interesting project concerns fire safety and is being conducted together with researchers from Örebro University, among other institutions. The project is investigating the possibility of using remote-controlled work vehicles as fire-fighting units.

“It means we won’t have to risk lives in the event of a rescue operation,” says Peter.

Another project is the rescue function that is used in our underground mines. In an emergency, the system will strip away all production-related information and only show people and rescue chambers. This will allow targeted efforts to help employees in a specific location.

“This not only provides support for personnel in our operations center, but also for the emergency services. Just being able to see a 3D view with the people in danger clearly indicated before the rescuers go down into the mine is a huge help,” says Peter.

Hottest projects right now

As an early adopter of mine automation, Boliden has taken on something of a client role. The company acts as a test facility, as well as the standards setter for a number of different projects.

“The highest priority projects at the moment are autonomous trucks and robotic remote chargers for explosives. But fully autonomous mining robots are probably still some way off,” concludes Peter.

mines. The latter is currently Sweden’s most modern mine.

A clear strategy is to avoid specialist solutions that only work in the company’s own environment. It must be possible to see the solutions developed with our various partners on a global market.

“If we take the wireless network as an example, in our case it is an extension of the office network. It is not mine-specific and contains no unique components. The phones we use are another example. We are now in the process of introducing smartphones with Android so that miners can use regular apps even when working underground. The communication radio will also be app-based,” says Peter.

Wireless networks allow the use of positioning systems, which have a number of advantages.

“The mine used to be like a black hole, but now we can see what is happening down there in real time. We can do things like controlling the ventilation depending on where in the mine vehicles are located and whether or not they are operating, thus sparing the environment and conserving resources. This technology also leads to reduced emissions, as operators can plan their runs better and use ecodriving,” explains Peter.

Safety the biggest gain

While all of the projects in the mine

PRECIOUS GOLD AND SILVER

Approximately 3,000 tonnes of gold are mined annually around the world, and the jewelry industry remains the biggest consumer of this precious metal. The properties of gold mean it is also very much in demand within the electronics, space and pharmaceutical industries. Phones and computers are two good examples of products where gold is an important metal. A significant portion of global silver production is also used for jewelry.

Globally, just over half of all silver produced is used in the electrical and electronics industries. Silver is also the metal that conducts heat and electricity best, and it is used for such things as electrical contacts, high-capacity batteries and electronic circuit boards in phones and computers.

961.93°C

The melting point of silver is 961.93°C.

Phones and computers are two good examples of products where gold is an important metal.



18,000 kilos

Boliden produces almost 18,000 kilos of gold every year.

92.5%

The finest silver in the jewelry industry is so-called Sterling silver, which consists of 92.5 percent silver.

25%

About a quarter of the silver processed at the Rönnskär smelter comes from recycling electronic waste

A gilt-edged 100-year history



On December 10, 1924 gold fever broke out in Boliden. Test drilling in an area known as Fågelmýran revealed the presence of the Boliden ore body – Europe’s richest ore. A new community, Sweden’s very own Klondike, is established and a gold rush begins. However, this wasn’t the first time this had happened.

Gold fever hit for the first time in Skellefteå and the surrounding area in the early years of the 20th century. A company was set up to acquire mining concessions and conduct surveys, but that particular venture was less successful and went bankrupt in 1918. A shortage of metal during the latter years of World War I prompted renewed interest in ore exploration in the area. A new type of speculative company, known in Swedish as an ‘emissionsbolag’, was established by the banks.

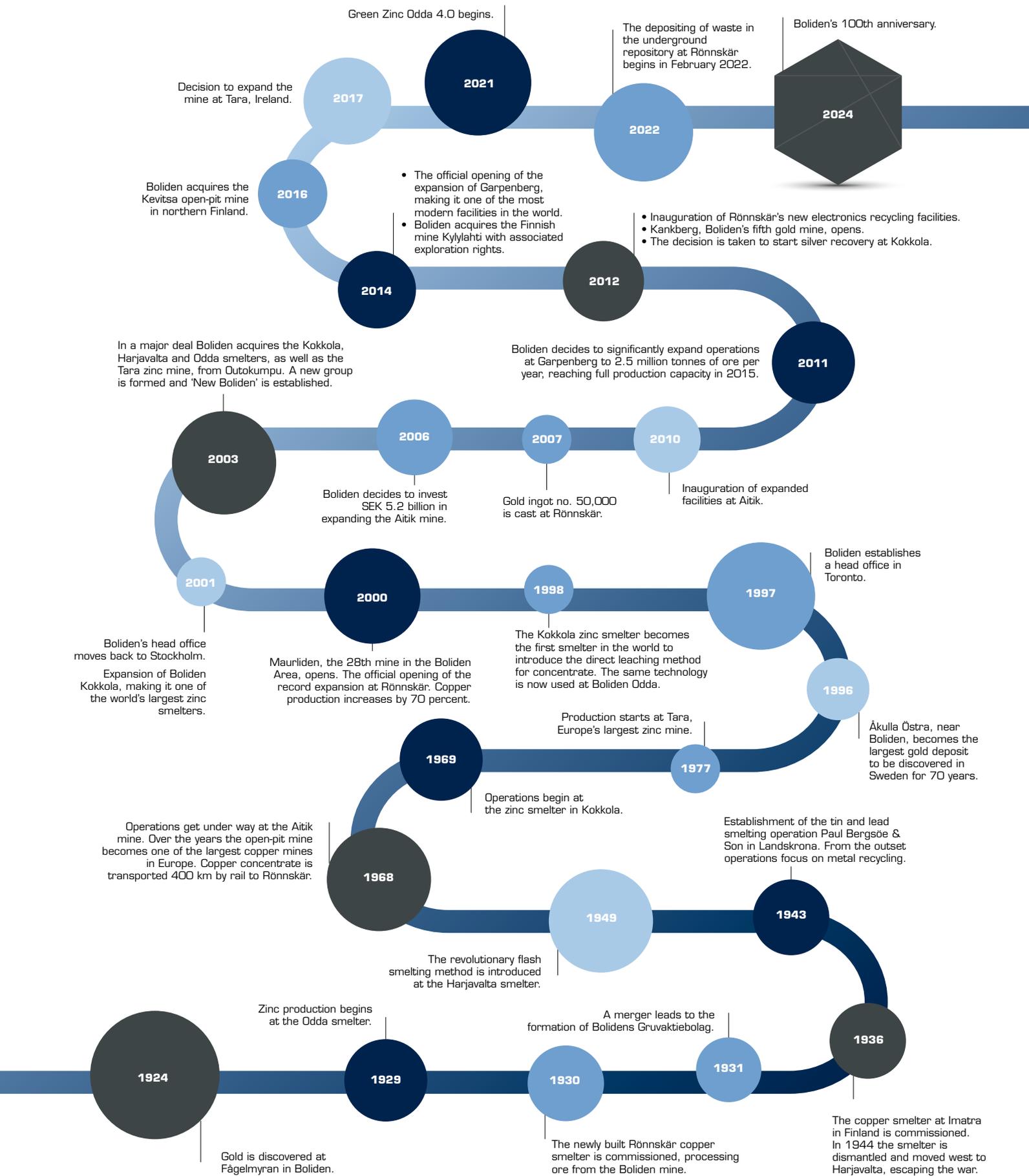
The Boliden we know today has its origins in one such company, Centralgruppens Emissionsbolag. In November 1924 the first borehole was drilled in the Boliden Area. On examination, the core was found to contain interesting samples. A number of other holes were drilled before the Boliden ore body was discovered on December 10.

The community of Boliden rapidly developed close to the mine. In 1926 a set of town plans was proposed, which showed the town laid out in the unique shape of a fan. The mining community took on the character of a well-organized, peaceful and idyllic residential area.

While the world was experiencing the Great Depression in the 1930s, Boliden’s Skellefteå operations flourished. This led to economic development in the region and local population growth. The number of employees rose steadily, and by 1935 the workforce numbered 2,500.

Over time more deposits were discovered close to Boliden and more mines opened – so far there have been 30. Activities at the actual Boliden mine continued until 1967.

In 2024, it will be 100 years since the Boliden ore body was discovered at Fågelmýran. We want to remember, in particular, the innovations that changed the industry, the people who made it possible, and how we have developed together with the communities in which we operate. Several generations have worked at Boliden, and we want to celebrate the pride associated with being a Boliden employee, which has helped ensure a prosperous first 100 years.



BOLIDEN SITES



The Boliden Area Three mines in a mineral-rich field

Today, the area is home to the Renström, Kristineberg and Kankberg underground mines. With the exception of Kankberg, they produce complex ores, which contain zinc, copper, lead, gold and silver.

The area also has a concentrator and a leaching plant for gold and tellurium production. The tellurium mined in the Kankberg mine is used for solar cell production, among other things.

The concentrates are then supplied to our own smelters, lead smelters in Europe and tellurium customers in Asia.



Bergsöe Supporting the lead cycle

Bergsöe in Landskrona is the only secondary smelter for lead in the Nordic region and one of Europe's largest recyclers of used lead batteries. Every year, lead from 4 million scrapped car batteries is recovered, and at least 70 percent of the lead produced is sold to the battery industry in Europe, where it is re-used.

Lead is fully recyclable and can be recycled time and again. Bergsöe is therefore an important link in the cycle of this important metal.



Garpenberg The world's most productive underground zinc mine.

Complex sulfide ore containing zinc, silver and lead is mined at Garpenberg, along with small quantities of copper and gold.

Metal concentrates from Garpenberg are supplied to Boliden's smelters and to European lead smelters.



Harjavalta One of the world's most efficient copper and nickel smelters

Harjavalta refines copper and nickel concentrates. The main products are copper, nickel mattes, gold and silver, as well as by-products such as sulfuric acid.



Kevitsa An open-pit mine in one of Finland's largest mineral deposit areas

The Kevitsa open-pit mine was acquired by Boliden in June 2016. The mine produces ore concentrate containing copper, nickel, gold, platinum and palladium. The operation includes a mine and a concentrator, both of which were commissioned in 2012.



Kokkola Europe's second largest zinc producer

In total, there are about 40 different zinc products in Kokkola's portfolio, which include both pure zinc and customized products for certain customers and customer segments. Zinc is used in cars, bridges, batteries, light poles, construction... in everything that our modern lifestyle requires.

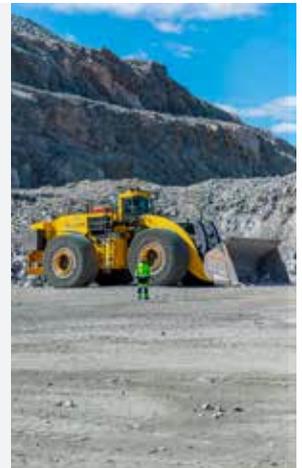
Thanks to continuous improvements, our low emissions and energy efficiency are world-class.



Aitik The world's most efficient open-pit copper mine

Aitik, just south of Gällivare in Lapland, is Sweden's largest open-pit copper mine. Here, ore deposits of copper pyrite containing copper, gold and silver are mined around the clock.

Operations at Aitik use some of the world's largest machines. Among them are rock dumpers weighing 570 tonnes when loaded, with the wheels alone measuring four meters in diameter, and excavators that can hold up to 45 cubic meters of rock in their buckets. At this site almost 40 percent of the machine operators are women. That is something that we take pride in and it makes us one of the more gender-equal mines in the world.





Odda

Zinc for Europe's steel industry

The primary raw material is zinc concentrate for zinc production. A secondary raw material is recycled zinc. Annual zinc production today is 200 ktonnes. However, investments are in hand to increase zinc production capacity to 350 ktonnes. Zinc production at Odda is a world leader in terms of climate efficiency.



Offices

Stockholm: Head office and Boliden Smelters

Boliden: Boliden Mines



Tara

Europe's largest zinc mine

Tara in Ireland is Europe's largest zinc mine and also one of the larger mines globally. In addition to zinc, it also produces lead concentrate. Metal concentrate from Tara is supplied to Boliden's own smelters and to European lead smelters.

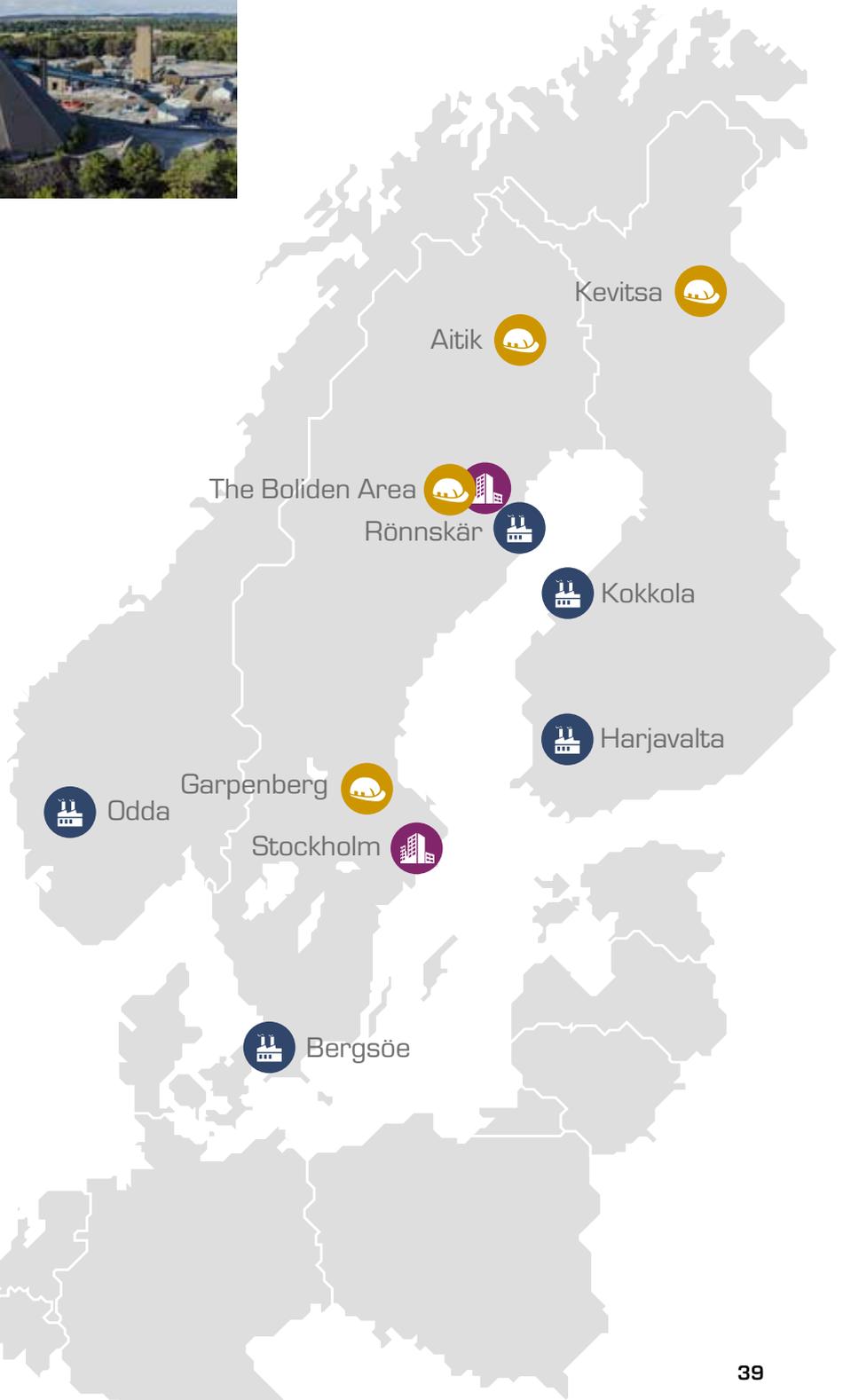


Rönnskär

A world leader in recycling electronics

Rönnskär in Skelleftehamn is one of the world's most efficient copper smelters. The plant receives deliveries of copper and lead concentrates from our own mines, as well as from external suppliers.

Thanks to investments and continued development of its kaldor technology, this smelter is today a world leader when it comes to recycling electronics. It is mainly copper, gold and silver that are extracted from these materials.



We create
the future
of metals.

Do you want
to join us on
our journey?



Drive change for
generations to come

WIMBOLIDEN