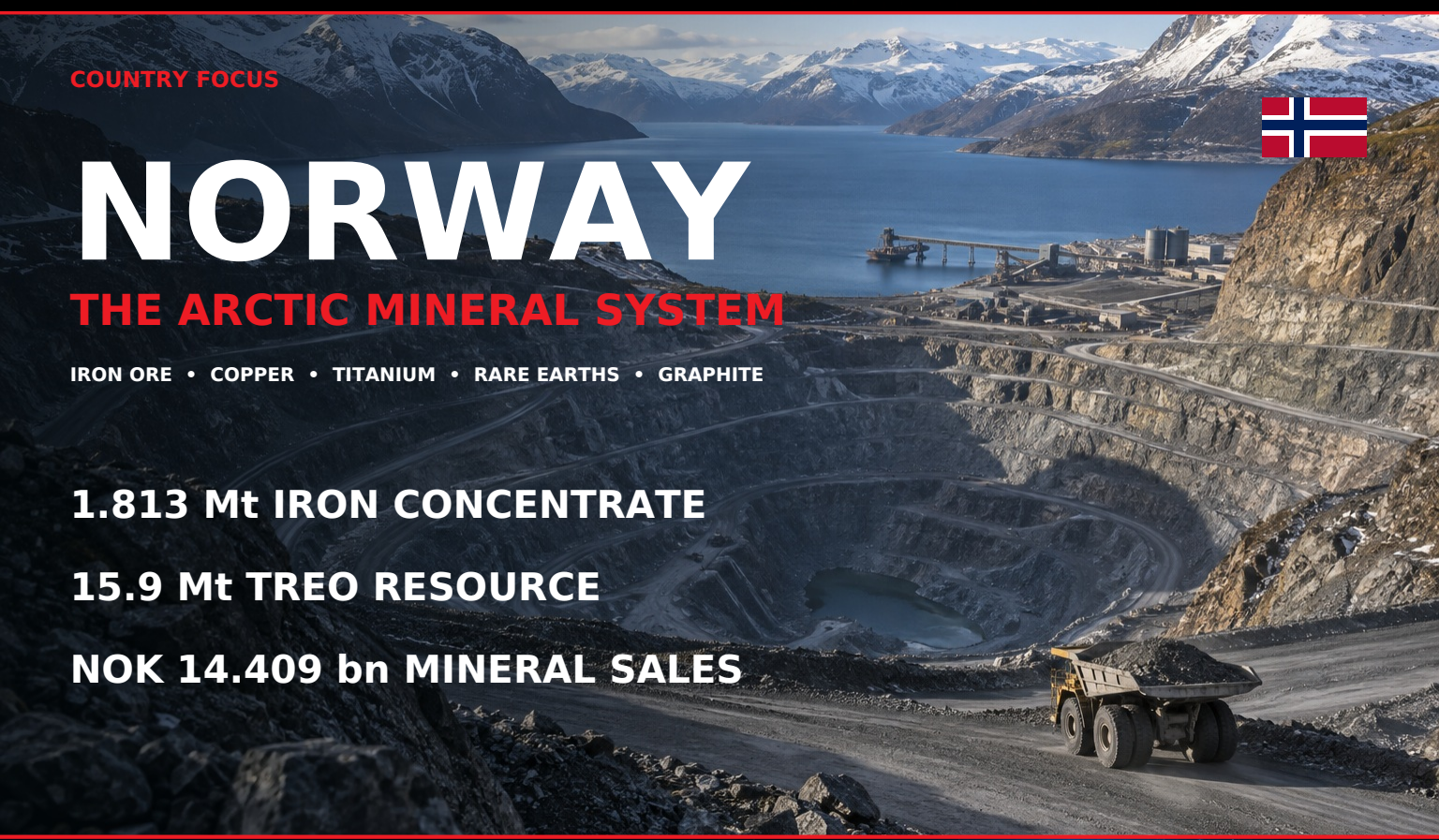
GSR ANALYTIX

ISSUE 05
SEPTEMBER 2026
GLOBAL EDITION

MINING MAGAZINE

WORLD MINING OUTLOOK

CRITICAL MINERALS • TECHNOLOGY • INVESTMENT • SUSTAINABILITY



COUNTRY FOCUS

NORWAY

THE ARCTIC MINERAL SYSTEM

IRON ORE • COPPER • TITANIUM • RARE EARTHS • GRAPHITE

1.813 Mt IRON CONCENTRATE

15.9 Mt TREO RESOURCE

NOK 14.409 bn MINERAL SALES

WORLD MINING BRIEF

HIGH-GRADE IRON
ORE QUALITY COMMANDS PREMIUMS



CONCENTRATE PRESSURE
SMELTERS COMPETE FOR FEED



RARE EARTH PROCESSING
SEPARATION DEFINES SECURITY



GLOBAL CRITICAL MINERALS • TECHNOLOGY • INVESTMENT



CRITICAL MINERALS | MINING TECHNOLOGY | EQUIPMENT | ESG & SUSTAINABILITY | GLOBAL INVESTMENT

ISSUE MAP

25 PAGES. ONE SYSTEM.

Norway depth first. Global sector intelligence follows. No white pages; no empty panels.

60% NORWAY | 30% WORLD | 10% FRONT

NORWAY

03 NORWAY AT SCALE
04 IRON BUILDS THE BASE
05 COPPER MOVES NORTH
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25 CAPITAL FOLLOWS CONVERSION

Editorial structure: 15 Norway pages, 8 World News pages, cover and contents.

NORWAY

COUNTRY OVERVIEW

NORWAY AT SCALE

High-grade ores, low-carbon power and fjord logistics define the system.



RESERVE → INFRASTRUCTURE → PROCESS → ESG

NOK 14.409 bn
MINERAL SALES | 2024

NOK 7.761 bn
EXPORT VALUE | 2024

53.9%
EXPORT SHARE | 2024

01 **RESERVE**
Iron ore, copper, titanium, graphite and rare earth resources anchor a diversified northern mineral base.

02 **INFRASTRUCTURE**
Ice-free fjords, hydropower, roads and established process sites compress the distance from ore to export.

03 **PROCESS**
Beneficiation, magnetic separation, flotation and mineral conversion determine how much domestic value is retained.

04 **ESG**
New permitting rules, Sami consultation, water controls and closure security define executable tonnage.

GSR ANALYTIX
COMMENT

Norway has a compact mineral system: high-grade feed, low-carbon power and direct fjord access. The constraint is converting geology into stable qualified output.

Sources: Directorate of Mining, Hard Facts 2024; Norway Mineral Strategy.

NORWAY

COUNTRY FOCUS

IRON ORE

IRON BUILDS THE BASE

Rana Gruber converts Arctic ore into high-grade hematite and magnetite.

OPERATING FRAME

Iron reserve value is tested by product grade, recovery, carbon intensity and export cadence.

1.813 Mt	CONCENTRATE | 2025
65% Fe	PRODUCT GRADE
188 kt	MAGNETITE | 2025





PROCESS / FIELD DETAIL

01 **RESERVE**

Five deposits support a long-life iron ore system; ore quality controls the route to higher-value products.

02 **INFRASTRUCTURE**

Underground and open-pit feed connects to beneficiation, storage and an ice-free export corridor.

03 **PROCESS**

Crushing, grinding and magnetic separation produced 1.625 Mt hematite and 188 kt magnetite in 2025.

04 **ESG**

A disclosed intensity of 7.25 kg CO2e/t concentrate strengthens the low-carbon product case.

GSR ANALYTIX

COMMENT

The margin is built through grade and recovery. Moving from 65% Fe toward 67% Fe strengthens the direct-reduction case without expanding the mine footprint.

Source: Rana Gruber Annual Report 2025.

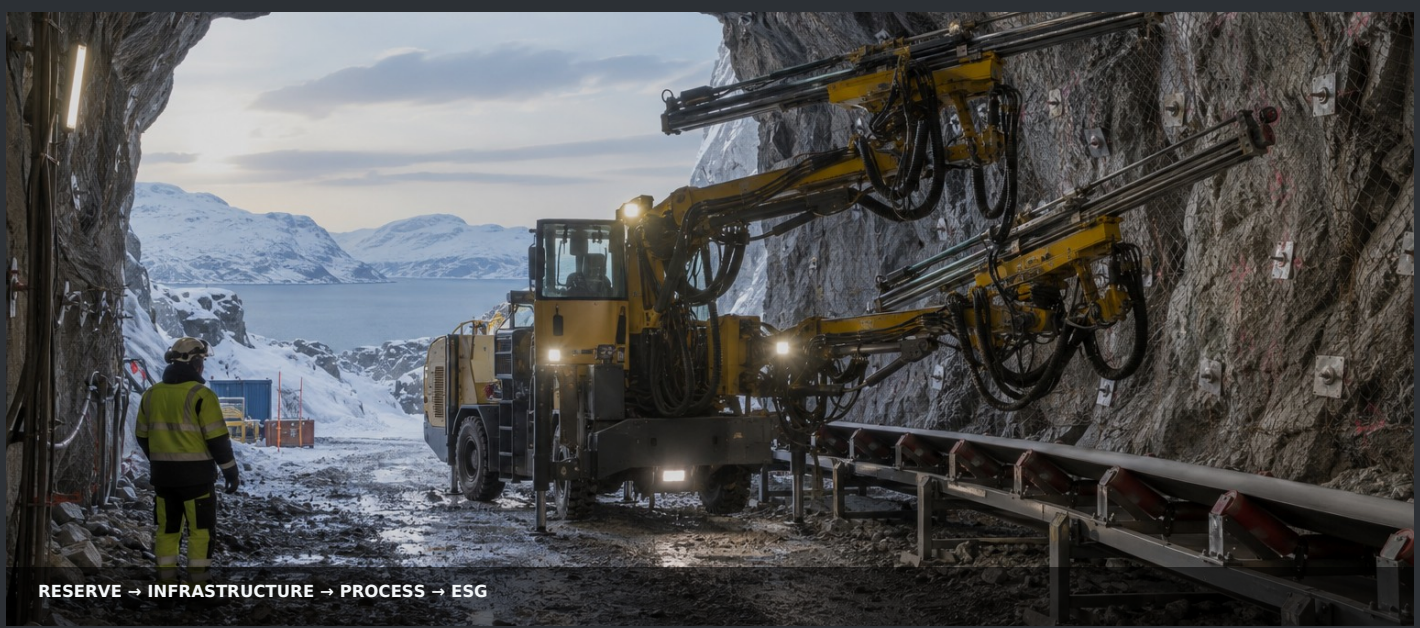
NORWAY

COUNTRY FOCUS

COPPER

COPPER MOVES NORTH

Nussir links defined grade, high recovery and compact fjord logistics.



24.98 Mt
ORE RESERVE

0.81% Cu
RESERVE GRADE

96%
COPPER RECOVERY

01 **RESERVE**
The reserve contains 202.1 kt copper plus gold and silver credits across a planned 13-year mine life.

02 **INFRASTRUCTURE**
A 6,000 t/d underground operation is designed around renewable power and year-round ice-free port access.

03 **PROCESS**
The feasibility case targets 14.6 kt/y copper with flotation recovery fixed at 96%.

04 **ESG**
Underground mining reduces surface disturbance, but tailings, fjord protection and Sami rights remain decisive controls.

GSR ANALYTIX
COMMENT

Nussir combines 0.81% Cu reserve grade with 96% recovery. Execution now depends on underground advance, tailings control and permit durability.

Sources: Nussir Feasibility Study 2026; European Commission strategic-project decision.

NORWAY

COUNTRY FOCUS

TITANIUM

TITANIUM ENTERS RAMP-UP

Engebo must convert mined rock into stable rutile and garnet output.

OPERATING FRAME

Rutile and garnet value depends on stable feed, liberation, recovery and product qualification.

2.128 Mt ROCK MINED | 2025

35,000 t/y RUTILE DESIGN

200,000 t/y GARNET DESIGN





PROCESS / FIELD DETAIL

01 **RESERVE**

A 39-year mine plan gives scale; delivered value depends on selective feed and mineral liberation.

02 **INFRASTRUCTURE**

Coastal quarry, process plant, storage and direct shipping create a compact bulk-mineral corridor.

03 **PROCESS**

Crushing, grinding, gravity and flotation circuits must move from commissioning variability to repeatable recovery.

04 **ESG**

The operating case estimates 3,085 tCO2e annually and requires disciplined water and residue control.

GSR ANALYTIX

COMMENT

Installed capacity is not saleable tonnage. Engebo must close the gap between commissioning output and repeatable rutile and garnet specification.

Sources: Nordic Mining Annual Report 2025; Engebo project disclosures.

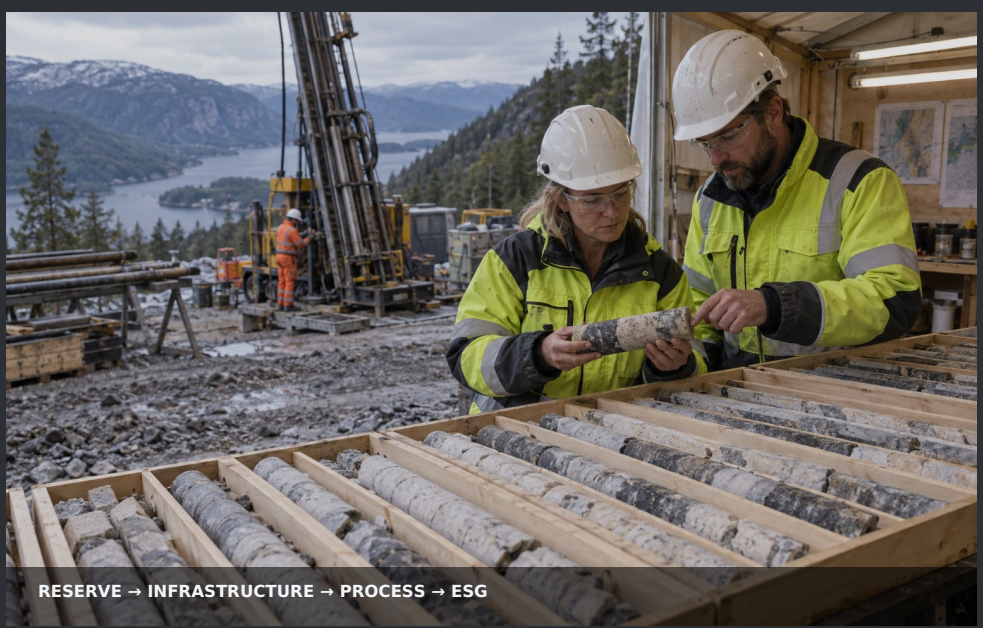
NORWAY

COUNTRY FOCUS

RARE EARTHS

FEN RESETS EUROPE

Resource scale is established; separation and permitting now set value.



RESERVE → INFRASTRUCTURE → PROCESS → ESG



FIELD DETAIL

15.9 Mt
TREO CONTENT | 2026

+80%
RESOURCE GROWTH

19%
NdPr SHARE OF TREO

01 **RESERVE**
Fen contains a large carbonatite-hosted rare earth resource with material magnet-metal exposure.

02 **INFRASTRUCTURE**
Drilling, pilot laboratories, reagents, power and secure residue storage must advance as one system.

03 **PROCESS**
Beneficiation and hydrometallurgical separation, not headline resource tonnage, determine saleable oxide output.

04 **ESG**
Radionuclide screening, water recirculation, residue stability and transparent land-use planning are approval gates.

GSR ANALYTIX
COMMENT

Fen is strategically large, but the investment case begins after beneficiation and separation work at scale. Resource tonnes cannot substitute for oxide qualification.

Source: Rare Earths Norway, updated Mineral Resource Estimate, 2026.

LITHIUM

LITHIUM STAYS EXPLORATORY

Pegmatite occurrences exist, but Norway has no active commercial lithium mine.

OPERATING FRAME

Lithium remains geological optionality until mineralogy, recovery and conversion are demonstrated.

0 t	MINE OUTPUT
4-7% Li2O	SPODUMENE RANGE
7-10 YEARS	TYPICAL DEVELOPMENT



01 **RESERVE**

Known pegmatites, including Hoydalen, remain exploration targets rather than reported economic reserves.

02 **INFRASTRUCTURE**

Any project must prove road, power, laboratory and conversion access before mine scale becomes relevant.

03 **PROCESS**

Mineralogy, liberation and spodumene concentration tests must precede any battery-grade conversion claim.

04 **ESG**

Small surface footprints still require water protection, waste-rock characterization and durable local consent.

GSR ANALYTIX

COMMENT

Norway has lithium geology, not a commercial lithium reserve. Mineralogy, recovery and conversion routes must be proven before valuation moves beyond exploration.

Sources: Geological Survey of Norway; Norwegian Mineral Strategy; Prosess21.

GRAPHITE + GOLD

GRAPHITE AND GOLD OPTIONS

High-grade graphite and copper-linked gold widen the product map.



23.6% Cg
TRAELEN DEPOSIT

10,000 t/y
GRAPHITE CAPACITY

75 koz Au
NUSSIR RESERVE

01 **RESERVE**
Traelen provides high-grade flake graphite; Nussir adds 0.09 g/t gold as a copper by-product credit.

02 **INFRASTRUCTURE**
Island mine access, underground services and concentrate logistics determine graphite continuity.

03 **PROCESS**
Flake preservation, purification and gold recovery require separate flowsheets and qualification standards.

04 **ESG**
Traceable carbon intensity, residue control and underground safety support access to strategic markets.

GSR ANALYTIX
COMMENT

High-grade graphite supports a differentiated product, while gold strengthens copper economics as a credit. Each requires separate recovery and market qualification.

Sources: Mineral Commodities, Skaland disclosures; Nussir Feasibility Study 2026.

NORWAY

COUNTRY FOCUS

LOGISTICS

FJORDS MOVE THE TONNES

Short mine-to-port corridors convert Arctic location into export leverage.

OPERATING FRAME

Export value depends on winter continuity, moisture control, sampling and shiploading cadence.

7 SHIPS Q4 2025

~60 kt CARGO PER SHIP

100% RANA OUTPUT EXPORTED



01 **RESERVE**

A saleable reserve requires dependable movement of concentrate, reagents and critical spares.

02 **INFRASTRUCTURE**

Covered conveyors, stockpiles, shiploaders and ice-free berths operate as one export asset.

03 **PROCESS**

Moisture, blending, sampling and loading cadence protect product quality and commercial settlement.

04 **ESG**

Dust, maritime emissions, spill prevention and local traffic controls define corridor performance.

GSR ANALYTIX

COMMENT

A short Arctic corridor is a structural advantage only when loading cadence and product control remain stable through winter.

Sources: Rana Gruber Q4 and Annual Report 2025.

CAPITAL

CAPITAL TARGETS CONVERSION

Funding moves toward projects with proven grade, process and corridor logic.



RESERVE → INFRASTRUCTURE → PROCESS → ESG



FIELD DETAIL

US$184 m
NUSSIR INITIAL CAPEX

US$235 m
NUSSIR NPV8

NOK 10 bn
FEN PHASE-ONE TARGET

01	RESERVE	Defined resources attract capital only after mining sequence and product specifications are credible.
02	INFRASTRUCTURE	Port access, renewable power, underground development and process construction set schedule certainty.
03	PROCESS	Pilot results, recovery guarantees and commissioning plans determine whether resource becomes cash flow.
04	ESG	Permit durability, consultation and closure funding directly affect discount rate and capital availability.

GSR ANALYTIX

COMMENT

Capital will rank grade, process recovery and corridor certainty above resource size. Projects with qualified product routes will move first.

Sources: Nussir Feasibility Study 2026; Rare Earths Norway project disclosures.

SUPPLY CHAIN

SUPPLIERS WORK THE NORTH

Cold-climate uptime depends on local service, parts and process competence.

OPERATING FRAME

Supplier performance is measured in restored tonnes, verified uptime and Arctic response capacity.

7	PRIORITY DEPOSITS
5	ACTIVE OPERATIONS
17	PROCESS COMPANIES



01 **RESERVE**

Diverse ore types require specialist drilling, assay, geometallurgy and underground-development services.

02 **INFRASTRUCTURE**

Regional workshops, winterized inventories and port-linked logistics reduce long-lead exposure.

03 **PROCESS**

Contracts must connect equipment availability to tonnes, recovery and product quality.

04 **ESG**

Supplier qualification must verify safety, labour standards, emissions data and material traceability.

GSR ANALYTIX

COMMENT

The critical supplier restores tonnes under cold-climate constraints. Local service capacity is an operating asset, not a procurement convenience.

Source: Prosess21, Critical and Strategic Raw Materials in Norway, 2026.

NORWAY

COUNTRY FOCUS

MACHINERY

MACHINES FACE THE CLIMATE

Arctic equipment must deliver traction, power and availability through winter.



RESERVE → INFRASTRUCTURE → PROCESS → ESG



FIELD DETAIL

5.524 Mt
ORE MINED | 2025

4.305 Mt
WASTE MOVED | 2025

7.25 kg
CO2e/t CONCENTRATE

01 **RESERVE**
Ore geometry, stripping demand and underground headings define the fleet architecture.

02 **INFRASTRUCTURE**
Charging, substations, heated workshops, communications and snow control are production assets.

03 **PROCESS**
Payload, dispatch and drill-to-mill data must stabilize plant feed across seasonal conditions.

04 **ESG**
Electrification lowers direct emissions; battery safety, tyre use and power provenance remain controlled variables.

GSR ANALYTIX
COMMENT

Arctic fleets must be evaluated as energy and maintenance systems. Charger, substation, workshop and snow control determine effective machine availability.

Source: Rana Gruber Annual Report 2025; GSR ANALYTIX fleet model.

NORWAY

COUNTRY FOCUS

DIGITAL OPERATIONS

AUTONOMY SHORTENS DISTANCE

Remote control links dispersed Arctic assets to one operating cadence.

OPERATING FRAME

Remote operations depend on governed data, resilient networks and controlled human override.

24/7	REMOTE CONTROL
<1 s	LINK TARGET
5 LAYERS	SENSE TO DECIDE



01 **RESERVE**

Ore models must update from drilling, loading and grade-control data without delay.

02 **INFRASTRUCTURE**

Private networks, edge compute, positioning and cybersegmentation are critical utilities.

03 **PROCESS**

Automated drilling, haulage and process control reduce variability only when data quality is governed.

04 **ESG**

Remote work reduces exposure, while human override, competence and algorithm assurance remain mandatory.

GSR ANALYTIX

COMMENT

Remote control can compress distance, but only governed data reduces variability. Automation without operating discipline transfers failure into software.

Sources: OEM autonomy frameworks; GSR ANALYTIX operating model, 2026.

NORWAY

COUNTRY FOCUS

PROCESSING

RECOVERY DEFINES MARGIN

The fastest additional tonne is often already inside the plant.



5.524 Mt
ORE FEED | 2025

1.813 Mt
CONCENTRATE | 2025

67% Fe
TARGET | 2029

01 **RESERVE**
Mineralogy and feed variability determine how much geological tonnage becomes qualified product.

02 **INFRASTRUCTURE**
Grinding power, water circuits, separators, thickeners and maintenance windows limit conversion.

03 **PROCESS**
Magnetic separation and control stability must raise grade without sacrificing mass recovery.

04 **ESG**
Higher recovery reduces waste per saleable tonne and strengthens the low-carbon concentrate case.

GSR ANALYTIX
COMMENT

The fastest additional iron tonne is inside the beneficiation circuit. Higher grade must be achieved without surrendering mass recovery.

Source: Rana Gruber Annual Report 2025.

ESG + PERMITS

ESG SETS THE PERMIT

Low-carbon power does not remove land, water or consultation risk.

OPERATING FRAME

Low-carbon power must be matched by auditable land, water, consultation and closure controls.

~90%	HYDROPOWER SHARE
88%	PUBLIC HYDRO OWNERSHIP
1 JUL 2026	NEW MINERALS ACT



01 RESERVE	Economic reserve conversion must include closure, land access and realistic environmental controls.
02 INFRASTRUCTURE	Monitoring, water treatment, emergency response and community interfaces require permanent capacity.
03 PROCESS	Operational data must identify deviations before they become incidents or permit breaches.
04 ESG	Sami consultation, fjord protection, biodiversity and transparent closure security determine social durability.

GSR ANALYTIX

COMMENT

Hydropower lowers carbon intensity but does not settle land and water risk. Consultation and closure security remain hard production constraints.

Sources: Norwegian Water Resources and Energy Directorate; Government of Norway, Minerals Act 2026.

NORWAY

COUNTRY FOCUS

OPERATING RISKS

THE BOTTLENECK STACK

Ramp-up, permits, winter exposure and process stability compound.

OPERATING FRAME

Ramp-up, winter access, permits and process stability compound into one effective capacity limit.

150 t RUTILE | 2025

12,729 t GARNET | 2025

35,000 t/y RUTILE DESIGN





PROCESS / FIELD DETAIL

01 **RESERVE**

Large resources do not protect value when grade control, selectivity or mine sequence is unstable.

02 **INFRASTRUCTURE**

Weather, underground advance, grid connection, port cadence and critical spares can set the schedule.

03 **PROCESS**

Engebo ramp-up shows the gap between installed capacity and stable, qualified product output.

04 **ESG**

Permitting, Sami rights, tailings assurance and water performance can stop value before shipment.

GSR ANALYTIX

COMMENT

Norway faces a compound constraint: ramp-up, winter access, permitting and process stability. The weakest link defines effective reserve.

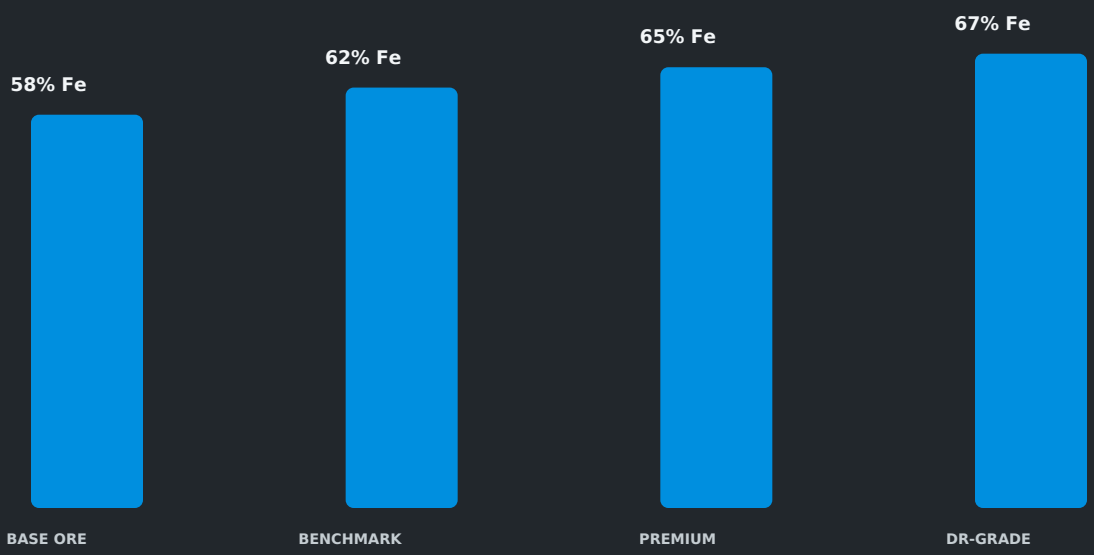
Sources: Nordic Mining Annual Report 2025; Government of Norway; Sami Parliament guidance.

GLOBAL IRON ORE

HIGH-GRADE IRON WINS

Steel decarbonization raises the value of cleaner, higher-grade feed.

IRON ORE QUALITY LADDER



~2.6 Gt
WORLD ORE | 2025 EST.

62% Fe
GLOBAL BENCHMARK

67% Fe
DR-GRADE TARGET

01 RESERVE	Large resources must deliver consistent iron grade and low impurity levels.
02 INFRASTRUCTURE	Rail, port, power and pelletizing capacity separate premium supply from stranded ore.
03 PROCESS	Beneficiation and magnetic separation upgrade feed for lower-emission steel routes.
04 ESG	Product carbon intensity and traceable energy increasingly influence realized premiums.

GSR ANALYTIX COMMENT

Steel decarbonization shifts value toward cleaner feed. Beneficiation capacity and low-carbon power now sit inside the ore premium.

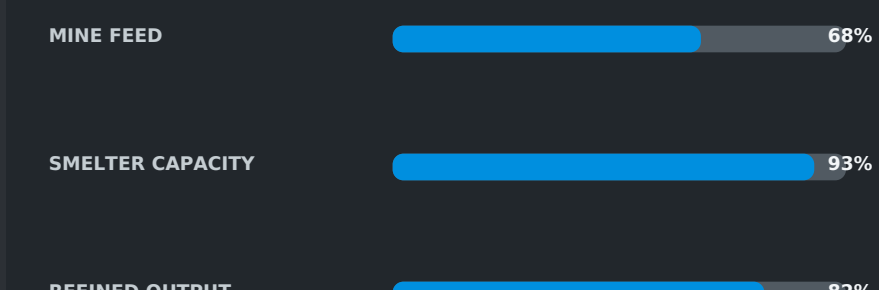
Sources: USGS Mineral Commodity Summaries 2026; GSR ANALYTIX grade framework.

PROCESSING

SMELTERS CHASE FEED

Conversion capacity is expanding faster than dependable concentrate supply.

CONCENTRATE PRESSURE





FIELD EVIDENCE

25%
COPPER GAP | 2035

4 INPUTS
POWER AIR ACID FEED

1 MARGIN
TREATMENT CHARGE

01 RESERVE	Mine delays and lower grades transmit directly into concentrate competition.
02 INFRASTRUCTURE	Smelters depend on power, oxygen, acid logistics, ports and compliant residue storage.
03 PROCESS	Blending, impurity control, heat recovery and digital optimization determine conversion margin.
04 ESG	Sulphur capture, arsenic control and scope-one intensity define expansion quality.

GSR ANALYTIX
COMMENT

New conversion capacity cannot create mine concentrate. Feed quality and availability will determine which smelters capture margin.

Source: IEA Global Critical Minerals Outlook 2026; GSR ANALYTIX.

CRITICAL MINERALS

RARE EARTHS REALIGN

Resource geography is broad; qualified separation remains concentrated.



17	19%	-9%
REE ELEMENTS	FEN NdPr SHARE	MINING INVESTMENT | 2025

01 RESERVE	Magnet-metal resources require mineralogy and recoverability, not tonnage alone.
02 INFRASTRUCTURE	Pilot plants, reagents, laboratories and secure residue storage set project readiness.
03 PROCESS	Separation and oxide qualification remain the strategic bottlenecks.
04 ESG	Traceability, water balance and residue chemistry shape market eligibility.

GSR ANALYTIX

COMMENT

Strategic autonomy is built in separation, not discovery. Qualified oxides and controlled residues determine supply-chain credibility.

Sources: IEA Global Critical Minerals Outlook 2026; Rare Earths Norway 2026.

NEW MACHINERY I

ELECTRIC SURFACE FLEETS

Battery, trolley and autonomy converge around the haul profile.



NEW MACHINERY / FIELD DEPLOYMENT

600+	40	43%
EPIROC BEVs | 2025	OPERATING SITES	EMISSION-FREE OFFERING

01 RESERVE	Long-life pits justify fixed charging and trolley infrastructure.
02 INFRASTRUCTURE	Substations, overhead lines, chargers and networks become fleet assets.
03 PROCESS	Payload, dispatch and autonomous drilling reduce feed variability.
04 ESG	Grid mix, battery origin and tyre consumption remain lifecycle controls.

GSR ANALYTIX COMMENT

The electric surface mine is a power system on wheels. Charging and trolley design must follow the haul profile.

Source: Epiroc Annual and Sustainability Report 2025.

NEW MACHINERY II

UNDERGROUND GOES ELECTRIC

Electric loaders and drills attack heat, fumes and ventilation cost.



NEW MACHINERY / FIELD DEPLOYMENT

10 t	262 tCO2e	+23%
ST10 G PAYLOAD	AVOIDED PER YEAR	TROLLEY PRODUCTIVITY

01 RESERVE	Deep and narrow mines reward compact equipment with high tractive performance.
02 INFRASTRUCTURE	Charging, battery swapping, fire controls and ventilation must be engineered together.
03 PROCESS	Electric torque and automation stabilize loading and tramming cycles.
04 ESG	Lower diesel particulate exposure improves underground working conditions.

GSR ANALYTIX COMMENT

Lower heat and fewer fumes create a direct operating case. Charging availability becomes the new ventilation-equivalent constraint.

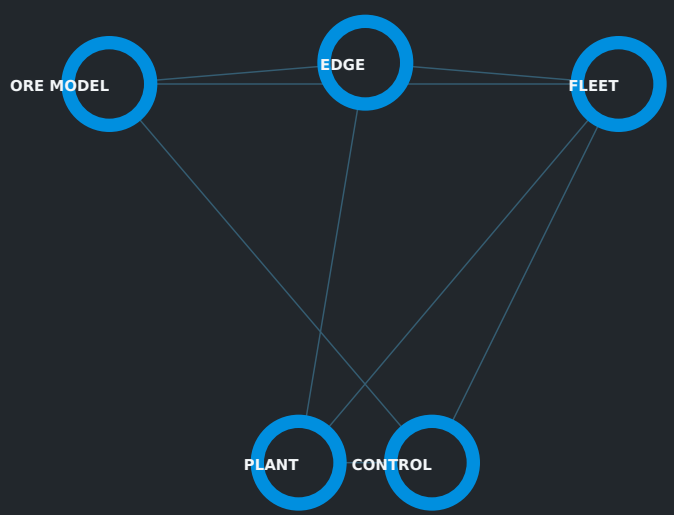
Source: Epiroc official electric-mining disclosures, 2025-2026.

AUTOMATION

AUTONOMY AT INDUSTRIAL SCALE

The control layer is becoming site-wide and production-critical.

AUTONOMY CONTROL STACK





FIELD EVIDENCE

5 bn t
CAT AUTONOMOUS HAULAGE

24/7
FLEET ORCHESTRATION

5 LAYERS
SENSORS TO CONTROL

01 RESERVE	Drill, fleet and plant data must share one operational ore model.
02 INFRASTRUCTURE	Networks, positioning and edge compute protect latency and availability.
03 PROCESS	Decision engines must optimize system throughput, not single-machine utilization.
04 ESG	Cybersecurity, human override and auditable algorithms are safety controls.

GSR ANALYTIX
COMMENT

Industrial autonomy requires one governed control layer across ore, fleet and plant. Local optimization can still reduce total output.

Sources: Caterpillar autonomous-haulage milestone; GSR ANALYTIX.

ENERGY + WATER

WATER TECH MOVES UPSTREAM

Water, energy and tailings choices now enter reserve economics.

OPERATING FRAME

Water technology now influences cut-off grade, process choice and reserve economics.

4 LOOPS INTAKE TO REUSE

1 BALANCE SITE WATER MODEL

100% CRITICAL FLOW TRACE



01 **RESERVE**

Water intensity changes cut-off grade and economic reserve definition.

02 **INFRASTRUCTURE**

Intake, treatment, storage, pumping and power form one system.

03 **PROCESS**

Thickening, filtration and real-time balance reduce make-up demand.

04 **ESG**

Discharge, catchment effects and closure liabilities require lifecycle design.

GSR ANALYTIX

COMMENT

Water technology now changes reserve economics. A project without a closed water and power balance does not have a complete mine plan.

Sources: IEA Global Critical Minerals Outlook 2026; GSR ANALYTIX water model.

CAPITAL + MARKET

CAPITAL FOLLOWS CONVERSION

Investors are pricing executable product, not resource headlines.

CAPITAL SCREEN



-9%
MINING INVESTMENT | 2025

16.5 YEARS
DISCOVERY TO OUTPUT

4 FILTERS
GRADE POWER WATER PERMITS

01 RESERVE	Resources without metallurgical confidence and sequence remain discounted.
02 INFRASTRUCTURE	Power, water, transport and tailings capacity determine deployment speed.
03 PROCESS	Recovery, ramp-up and product qualification control cash conversion.
04 ESG	Assured performance and community durability reduce delay risk.

GSR ANALYTIX
COMMENT

Capital is moving toward executable tonnes. Grade, infrastructure, recovery and permit durability determine valuation quality.

Sources: IEA 2026; Norwegian Mineral Strategy; GSR ANALYTIX.