A world designed to last

Mining & Metals

Integrated solutions from mining to processing



TECHNIP ENERGIES

Recognized expertise and capabilities worldwide

150
delivered projects

+50
years of experience

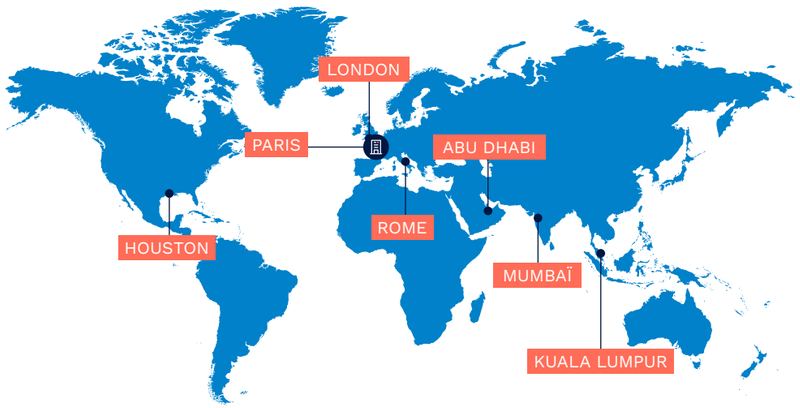
HIGH ENGINEERING SKILLS
in geology, mining and metallurgy

STRATEGIC PROCESS
for sustainable metals production

From mining to processing, Technip Energies has been an essential partner for the mining and metals industry for more than half a century.

With a proven track record of more than 50 years and a team of skilled professionals, we offer our clients an integrated approach across the mineral value chain worldwide from mining to processing. We are fully equipped to handle entire project lifecycles, from conceptual studies to EPCm. Our teams are dedicated to client service. They have wide-ranging operational and technical expertise across commodities, continents and mining methods, bringing their specialization to every level of our clients' businesses for the entire lifecycle of their assets.

Technip Energies key offices & engineering centers



Long-term collaboration and risk management

Technip Energies is known for offering our clients global industrial solutions focused on project performance. We have strong connections with ECA* s and are able to support them in project funding. We are committed to our clients in all phases from early studies to construction and startup.

One-stop shop

- Covering all project disciplines
- Involved in the entire mining and processing chain.

Long-term collaboration model

- Full risk endorsement from concept to EPC LSTK**
- Support for project financing based on Technip Energies' proven track record in delivering projects on time and within budget
- Innovative development of projects, optimized technical solutions and significant reduction in overall schedules from the master plan to plant startup
- Strong commitment in terms of overall
- cost, construction schedules and performance guarantees.

Risk management

- Early start of construction and production
- No additional financial risks
- Commitment to planning

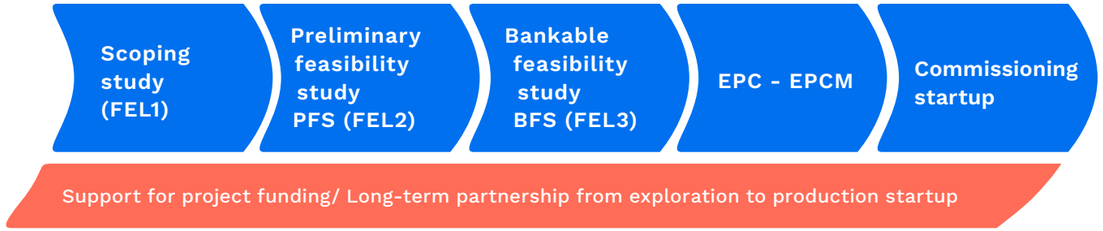
* Export Credit Agency
**EPC: engineering, procurement and construction



"We are committed to being a long-term partner with our clients."

A full range of services

Technip Energies addresses all client needs at the early project stage, from scoping studies to startup of industrial units and infrastructures. We perform small, medium and large-scale mining and minerals processing projects.



“Working with Technip Energies and its partners to provide the Master Plan and the DFS – within an estimated 14-month period followed by the provision of a fixed priced EPC contract (concluded on an open book basis) within three months of the completion of the DFS – allowed the company to accelerate the financing of the mine build as well as derisk the project for both offtakers and investors.”

Sean Bennett (CEO of Kore Potash until May 2018)

From scoping to feasibility studies

The success of a plant startup relies on project preparation and anticipation. The project is defined and matured through iterations and multiple arbitrations between key elements: CAPEX vs. OPEX, process vs. mine, industrial performance vs. CAPEX vs. schedule. We accompany our clients in initial plant design, technical choices and detailed definition of the technical and bankable project.

- FEL1 Concept/coping study: Description of the project
- FEL2 Prefeasibility: Tradeoff between all alternatives and final selection of the preferred project route
- FEL 3 Bankable feasibility study: Reliable CAPEX, OPEX and project schedules, key leverages for the final investment decision.

EPCM project realization

With proven success in multibillion euro projects, Technip Energies is one of the few companies that can convert FEED studies into a confirmed EPC offer by carrying all project risks, including cost, planning and performance.

Covering the entire value chain

JORC/NI 43 R&R in-house competent person

Our team of experts includes certified geologists and mining engineers competent in JORC/NI 43-101 certification. We have the capability to lead exploration from the drilling campaign, including the modelization and optimization of resources and reserves, using in-house Surpac and Whittle softwares.

Process plant design

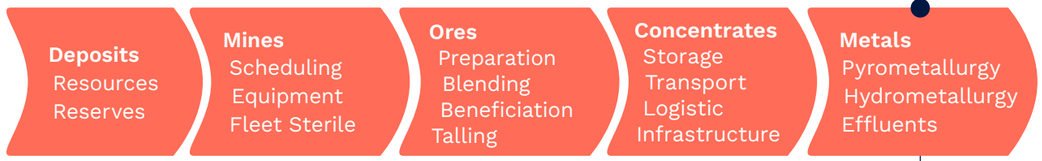
While ore processing is specific to each commodity, it generally involves a concentration phase (beneficiation) obtained by physical separation means, followed by a stage of purification (refining) via chemical processing: pyromet/hydromet. Our teams of senior experts, including former production managers, offer their expertise in all process specialties along the entire value chain using in-house Syscad & Metsim softwares.

Metallurgical test work

Test work provides process data that plays a key role in project definition. This generally begins with mineralogical analysis, followed by orientation tests to assess the best applicable technologies, and finally large-scale pilot tests for fine-tuning of the process. All of which results in OPEX optimization. The definition of tests and their supervision by our experts enables Technip Energies to define reliable process performance guarantees that we endorse within our EPC or EPCM proposal.



“A team of experts in all process specialities.”



Strategic metals for the energy transition

The energy transition will involve a greater dependence on nuclear, solar and wind power that rely on metals for production, transport and storage more than the fossil fuels of the past. In the next 10 years, demand for metals including copper, nickel and particularly cobalt will increase significantly.

x3
demand for metals required in the production of electric vehicles in 2030

x3
demand for copper, nickel, cobalt in 2030

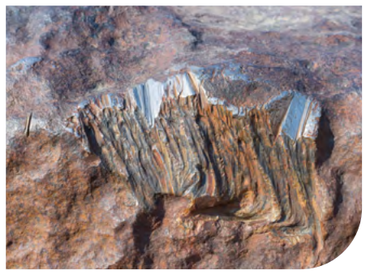
Committed to transforming the energy industry

We combine our EPC capabilities with our technological know-how to develop new solutions that will support the world's energy transition. We offer a range of design,construction and industrial applications that are key to the global transition to a less carbon-intensive economy. We are leveraging our engineering expertise and technologies to develop new projects in mining and metals and other solutions.

"Together with our clients, we are taking on the world's biggest energy challenges to build a better tomorrow."







Innovative solutions for lithium projects

As a main energy transition metal used in electric vehicles batteries, lithium projects are a top priority.

We offer a unique combination of capabilities fitting the needs of the various configurations of lithium projects:

- Hydrometallurgical process expertise: Several former production directors of metallurgical plants leading the M&M process team
- Owner of specific technologies dedicated to:
  - DLE lithium extraction and battery recycling: Krebs SX mixer settlers
  - To lithium sulfide processes: Fluosolid Fluid Bed Roaster.

Covering the full value chain:

- Extraction: DLE from brine or geothermal , rock lithium mining
- Refining and/or conversion: from TG To BG lithium carbonate, hydroxyde, sulfide.

INFINITY Lithium



- **Client:** INFINITY Lithium
  Project: San Jose Project
- **Technology/Capacity:** UG Mine + Flotation + Pyro/hydro > LiOH
- 25 ktpy for a first line (several lines programmed)
- **Location:** Spain, Extremadura
- **Scope:** FEL1 AACE class 4

TERRALITHIUM LLC



- **Clients:** TerraLithium, LLC / Oxy Low Carbon Ventures
- **Project:** Lithium hydroxide demonstration plant
- **Facility Capacity:** 75 mtpy of liquid lithium hydroxide monohydrate
- **Location:** US, Salton Sea, California
- **Scope/Purpose:** EP Services

VIRIDIAN Lithium



- **Client:** VIRIDIAN Lithium
- **Project:** Viridian lithium refining & conversion plant
- **Technology/Capacity:** BG LiCa & BG LiOH
- 25 ktpy for a first line (4 lines programmed)
- **Location:** France, Alsace
- **Scope:** FEL3 AACE class 3 +EPCM

ORANO Mining
Batteries recycling



- **Client:** ORANO Mining
- **Project:** Hyromet plant for EV battery recycling
- **Technology/Capacity:** 4,500tpy black mass + 4,500 tpy NMC
- **Location:** France
- **Scope:** Scoping study

Leading-edge proprietary technologies

Technip Energies' innovative in-house technologies help our clients create lifecycle value, giving them a competitive advantage in meeting their energy transition challenges.

Krebs Mixer-Settler for solvent extraction

The most compact mixer-settlers in the market

For 45 years, Technip Energies' proprietary Krebs Mixer-Settler technology has successfully been operated in solvent extraction plants (SX plants).
This liquid/liquid transfer technology is primarily used in the hydrometallurgy industry (mineral processing) for the recovery of metals such as uranium, cobalt, nickel, copper, REE*, zinc, lithium, molybdenum, manganese and magnesium.
Krebs Mixer-Settlers are designed to handle flows from 10 m^3/h to 3,000 m^3/h

They provide many advantages compared to conventional technology:

- Smaller settling area
- (size reduced by 50%)
- Design and operation reliability
- Low CAPEX and OPEX
- Simplified layout
- Easier transportation and reduced site work



References:

Sumitomo Metal Mining Harima, Japan: Design and supply of 17 Krebs Mixer-Settlers to produce cobalt chloride and nickel sulfate.

Orano – McClean Lake, Saskatchewan, Canada: Basic engineering, detailed engineering and procurement of a new solvent extraction unit to produce a concentrated uranium solution.

Cameco – Key Lake, Saskatchewan, Canada: Upgrades of five existing Krebs Mixer-Settlers to produce a concentrated uranium solution.

* REE: rare-earth elements



Dorr-Oliver FluoSolids® fluidized bed systems

We offer our clients extensive experience with Dorr-Oliver FluoSolids® fluidized bed systems for projects. With more than 1,000 references since 1943, Technip Energies is a leading provider of fluid bed systems and services. This technology is applied to roasting, calcination, combustion, preheaters and calcine coolers and drying.

Contributing to the energy transition

- Chemical and thermal efficiency
- Simple startup/shutdown that is easy to operate
- Uniform solids temperature in the bed
- Variable solids retention time
- Vertical, cylindrical design for efficient space utilization
- Low operating and maintenance costs improve overall sustainability
- Higher equipment availability
- No internal moving parts
- Long refractory life
- Heat recovery systems to reduce carbon footprints

References:

KGHM – Glogow I Smelter, Glogow, Poland: First-of-its-kind 480 mptd* copper concentrate dead roaster to reduce carbon and sulfur and improve metals production, as well as generate electricity from in-bed steam coil heat recovery (start-up 2018)

Koniambo Nickel (Glencore) Koniambo metallurgical plant, New Caledonia: 2 x 3,850 mptd nickel ore reduction roasters (commissioned in 2013 and 2014 respectively)

Vale – Copper Cliff smelter, Ontario, Canada: New nickel matte dead roaster (startup 2014)

Confidential Texas, USA 4,500 mtpd calcium carbonate calciner for CO_2 direct air capture (DAC) solid sorbent system (completed FEED in 2022)

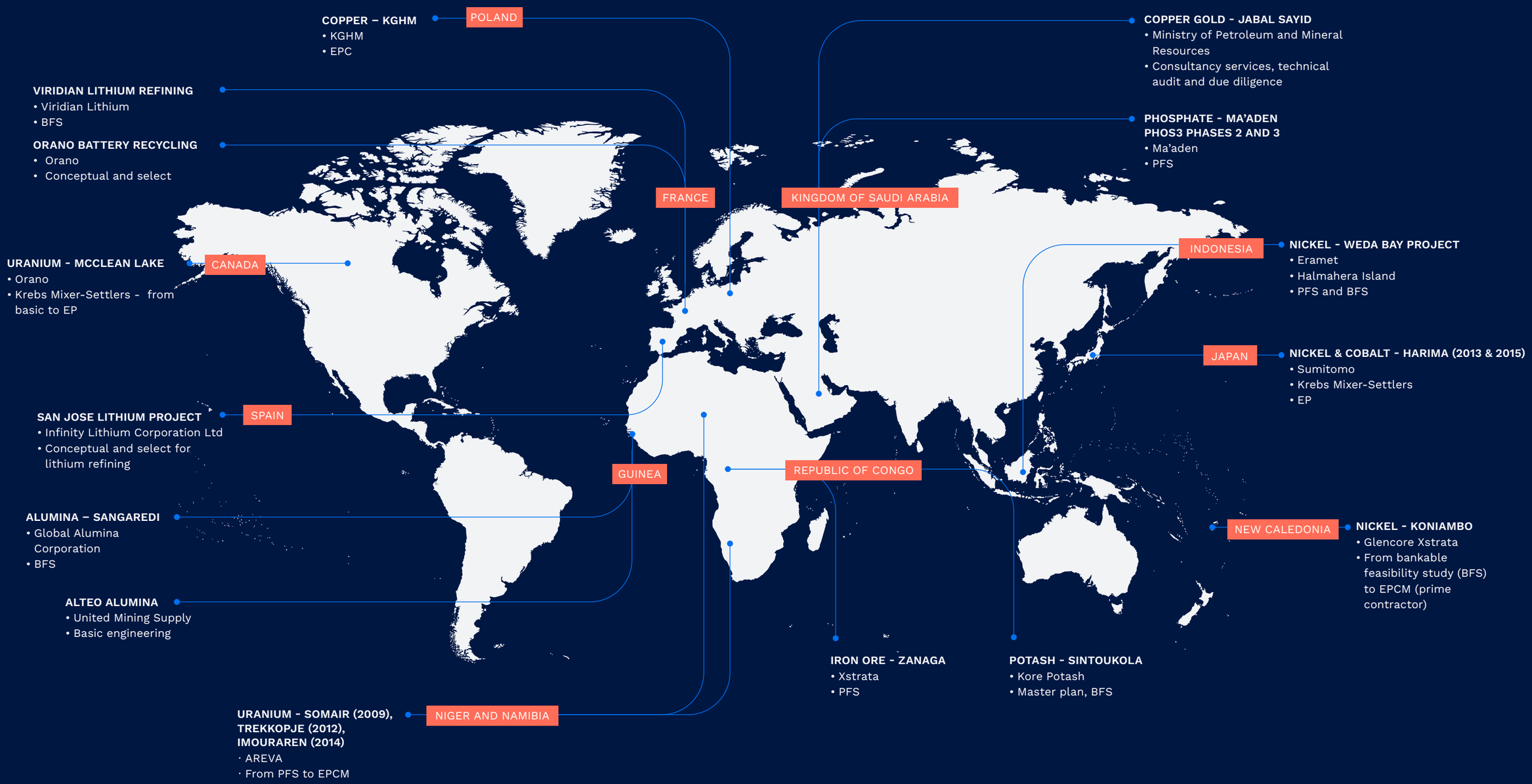
Barrick – Nevada, USA: 2 x 6,000 mptd whole gold ore dead roasters and technical services to optimize and increase capacity to >18,000 mptd and annual assessments to evaluate mechanical status (2000-2021)

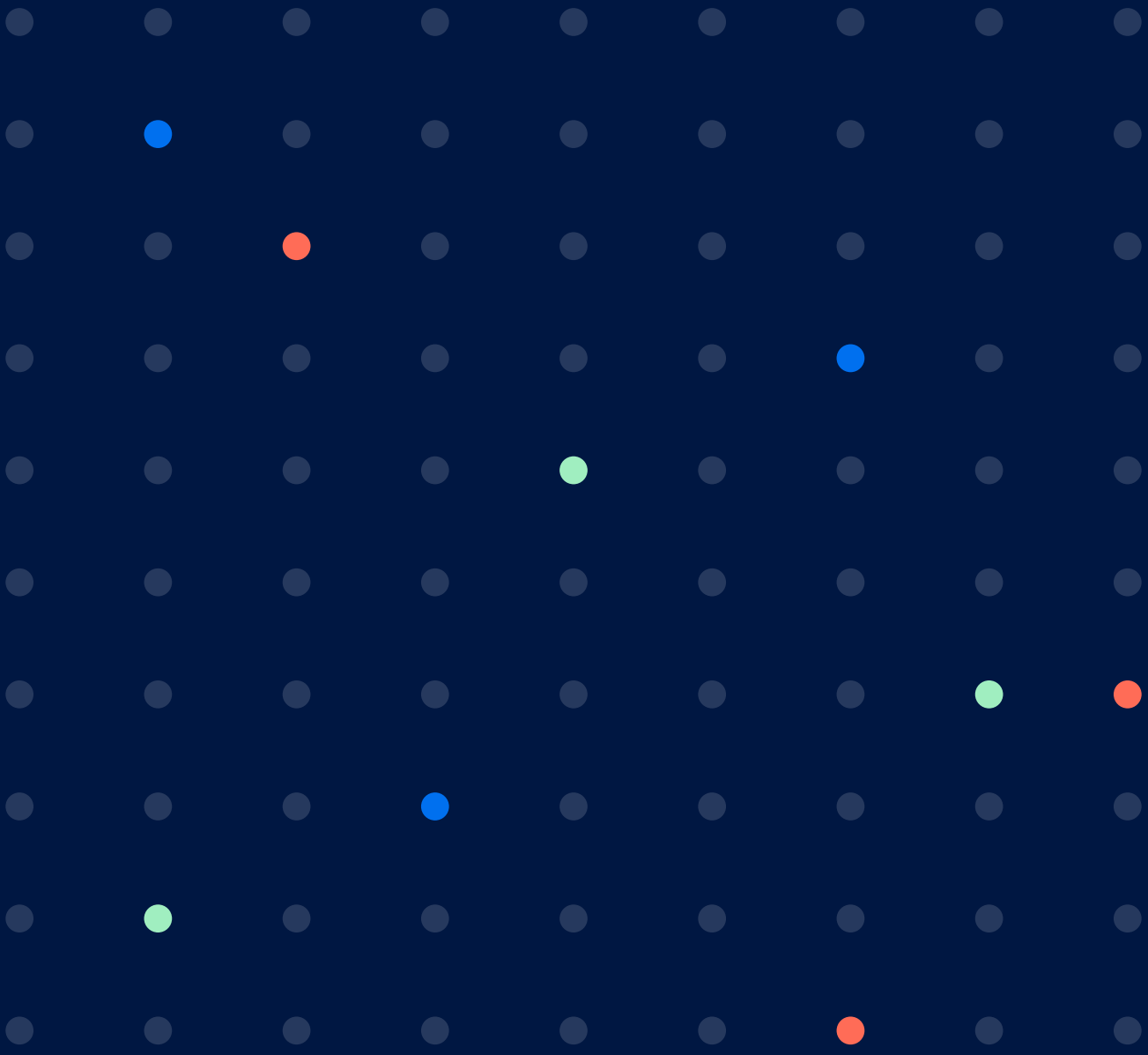
Resolute Mining (BHP) Syama, Mali West Africa: 4,960 mptd whole gold ore circulating fluid bed (CFB) roaster and technical services (1993-2004)

Technical Services: Various roasting and calcining system technical, revamp and process optimization for gold ore and gold concentrate, complex copper concentrates, zinc concentrate, phosphate rock, nickel matte and strategic metals recovery

* mptd: metric tons per day

Project references





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