

SRC Rare Earth Processing Facility



Saskatchewan:

▶ A Key Player in the Global Mining Industry

As the world looks to secure access to the critical minerals vital for telecommunications, computing and clean energy, Saskatchewan (and Canada) are well-positioned to meet that demand.

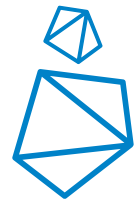


Out of all the Canadian provinces, Saskatchewan stands out in attracting most of the major global mining companies to the province due to its rich mineral resources, efficient regulatory environment, and substantial investment opportunities, combined with a high-quality geological database.

- ▶ The Fraser Institute ranks Saskatchewan as the most attractive jurisdiction in Canada for mining investment and the third highest globally.



- ▶ The Fraser Institute ranks Canada as the number one country in the world for mineral investment (based on the combined rankings of all the provinces and territories).



Saskatchewan is home to **23 of the 31** critical minerals—including lithium, cobalt, copper, nickel, zinc and rare earth elements (REE)—identified by the Government of Canada as essential for an economically secure, low-carbon economy.

The scale of production and the amount of resources Saskatchewan lands offer is extensive.



► WORLD'S LARGEST
PRODUCER OF POTASH

***30%**

OF GLOBAL PRODUCTION



► LEADING GLOBAL
PRODUCER OF URANIUM

16%

OF GLOBAL PRODUCTION



► CANADA'S LARGEST
PRODUCER OF HELIUM

60M ft³

OF HELIUM PRODUCED IN
SASKATCHEWAN ANNUALLY



Rare Earth Elements Industry

Rare earth elements (REEs) are a group of 17 elements in the periodic table. They exist in low concentrations in many places worldwide but finding element deposits in high concentrations suitable for commercial extraction is rarer.

- ▶ REEs are predominantly recovered from mineral concentrates of Monazite and Bastnaesite.
- ▶ Lanthanum and Cerium are the most widely produced elements and feed into various end-use applications.
- ▶ Neodymium and Praseodymium are the critical elements for permanent magnet manufacturing.
- ▶ Terbium and Dysprosium are key elements for high-performance magnets.

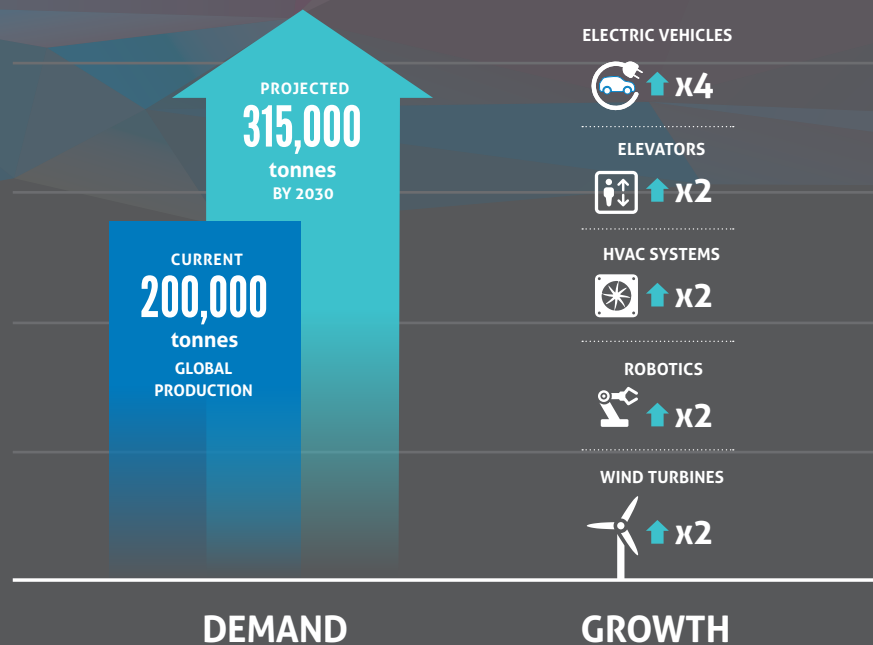
| | | | | | |
|------------------------------|---------------------------|---------------------------------|------------------------------|----------------------------|-------------------------------|
| 57 La Lanthanum | 58 Ce Cerium | 59 Pr Praseodymium | 60 Nd Neodymium | 65 Tb Terbium | 66 Dy Dysprosium |
|------------------------------|---------------------------|---------------------------------|------------------------------|----------------------------|-------------------------------|



REE Market Growth

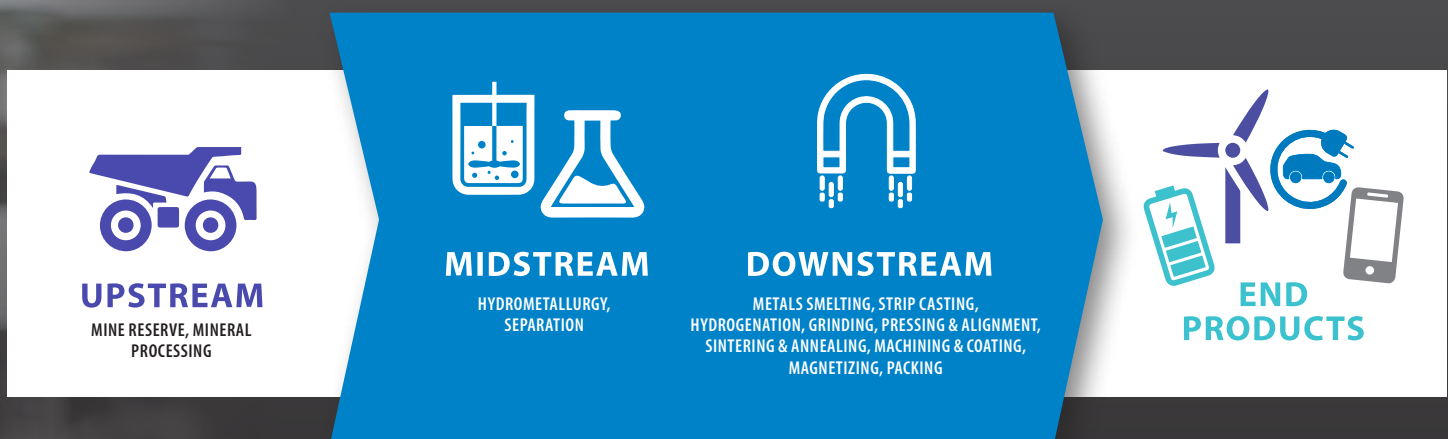
REEs are essential in many modern technologies, including wind turbines, cell phones and electric vehicles. Governments worldwide have deemed REEs “critical or strategic” minerals because of their unique properties and economic importance.

The REE market has experienced exceptional growth over the past couple of years and is expected to continue to grow in the coming years. This growth is directly related to the evolution of the energy sector, shifting from conventional fossil fuels to electric base sources, and net-zero emissions goals.



The annual demand for rare earth metals is projected to climb from around 200,000 tonnes currently to about 315,000 tonnes by 2030, creating enormous pressure and opportunity for global production.

REE Global Supply Chain



Most of the world has been dependent on foreign sources of critical materials for many decades. This import dependence can be a concern because it puts supply chains and material users at risk.

With the evolution in both the auto and energy industries, hydrocarbon demand is

diminishing and REE demand is increasing. The secure supply of rare earth elements and the resiliency of their supply chains are essential to meeting this demand.

The REE supply chain is complex and poses many challenges to develop because there are many individual stages of the full

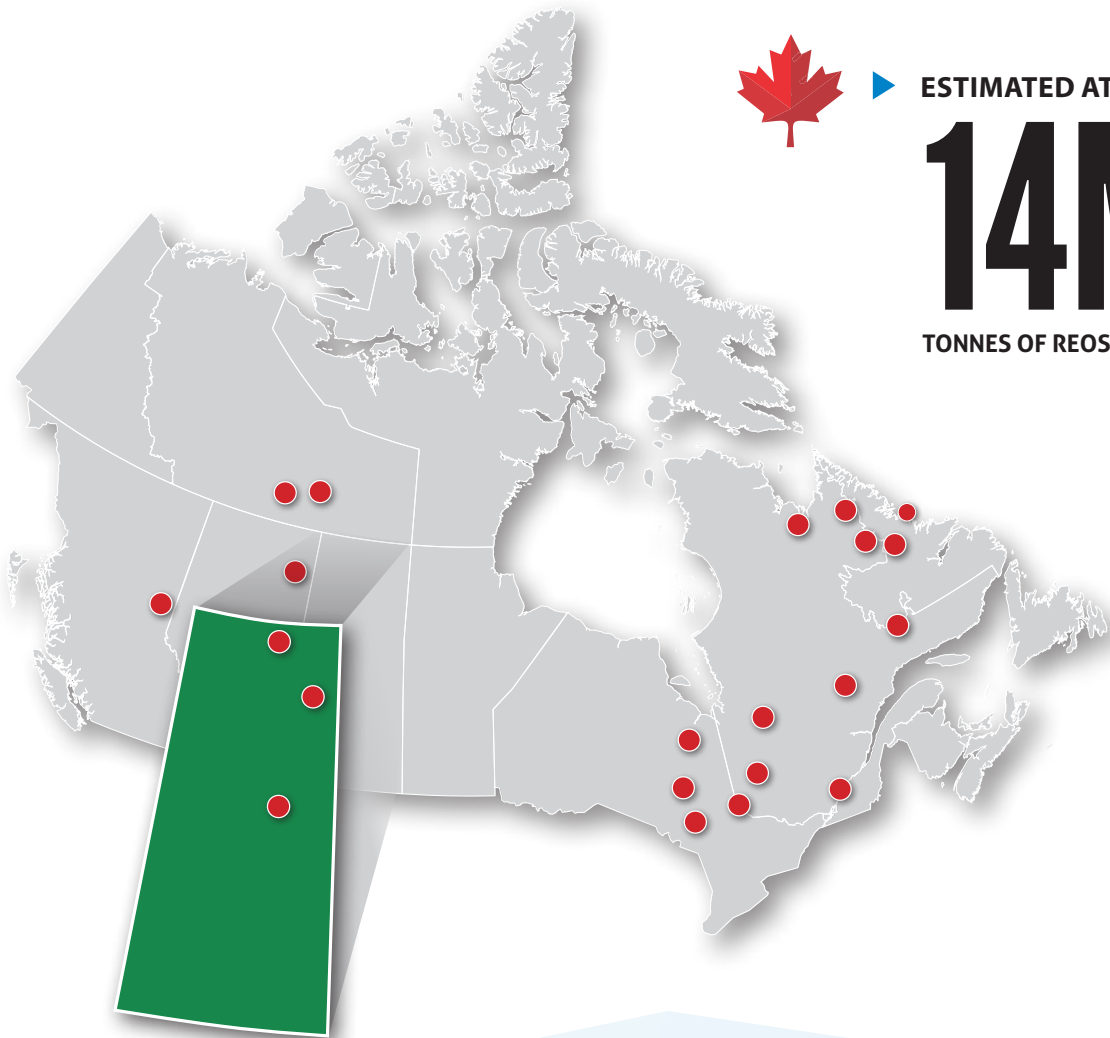
REE production chain including mining, beneficiation, hydrometallurgy, separation, metal alloys, magnets, original equipment manufacturers (OEM) and finally end use.

► REE Industry in Canada and Saskatchewan

Canada has some of the largest known reserves (measured) and resources (indicated) of rare earths in the world, estimated at over 14 million tonnes of Rare Earth Oxides (REOs) in 2021. Canada has about 7 per cent of the world's REE resources and is in tenth place in terms of reserves.

► These deposits are located in the Northwest Territories, northern Saskatchewan, Quebec, Ontario, Newfoundland & Labrador, and Alberta shale deposits. Currently, most of them are under exploration and have the potential to produce concentrated REE ore within the next five to ten years.

► With its plentiful REE deposits and considerable mining expertise and talent, Saskatchewan is well positioned to establish the REE processing industry, from mine to magnets.



► **ESTIMATED AT OVER**
14M
TONNES OF REOS IN 2021

► SRC Rare Earth Processing Facility – First of Its Kind in Canada

With support from the Government of Saskatchewan, the Saskatchewan Research Council (SRC) is constructing North America's first integrated, fully commercial, demonstration Rare Earth Processing Facility, with hydrometallurgy, separation and metals smelting units.

► The SRC Rare Earth Processing Facility is positioned as a catalyst to stimulate the resource sector in Saskatchewan and across Canada, providing the early-stage supply chain needed to generate industry investment and growth.

► The Facility will begin to establish an REE technology hub in Saskatchewan, forming an industry model for future commercial REE initiatives and supply chain development.



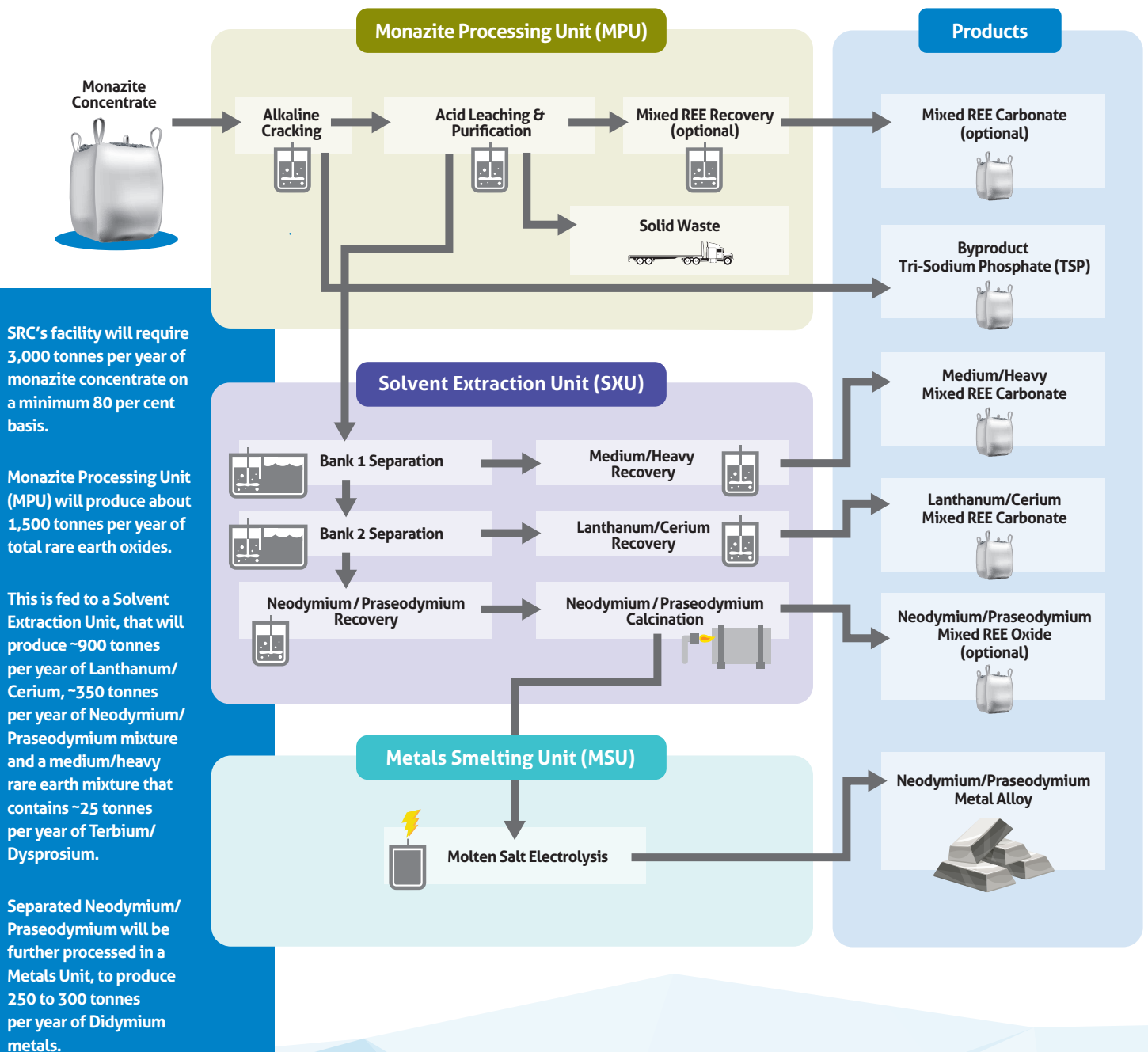
Artist's rendering of SRC Rare Earth Processing Facility.

SRC, one of Canada's leading research and technology organizations, has investigated lithium and REE technologies for over 15 years. SRC's Mineral Processing group, led by world-class REE experts, is recognized nationally and internationally as a centre of expertise in REE extraction and processing technology.

Production Capabilities

- ▶ The Monazite Processing Unit will be operation-ready in 2023. The Separation Unit and Metal Smelting Unit will both be operation-ready in 2024. All three units will be fully operational in 2025.
- ▶ SRC is open to discussing the offtakes for Monazite feed and the Separation and Metal Processing Units product line.
- ▶ SRC will also consider the toll processing of various materials in its facilities from 2026 on.

SRC Rare Earth Processing Facility (Zero Liquid Discharge)



REE Facility Products

| Solvent Extraction Unit (SXU) Product (tonnes per year) | | REO Distribution (tonnes per year, tpy) |
|--|-------|---|
| Lanthanum/Cerium Mixed Carbonate | ~1900 | $\text{CeO}_2 = \sim 600$ $\text{La}_2\text{O}_3 = \sim 300$ |
| Neodymium/Praseodymium Mixed Carbonate (Feed to Metal Smelting) | ~725 | Nd/Pr Metals = ~300 |
| Medium and Heavy REE Mixed Carbonate | ~450 | Medium REOs Sm, Eu, Gd = ~75 Heavy REOs Tb, Dy, Ho, Er, Tm, Yb, Lu, Y2 = ~125, with ~5 tpy of Tb and 20 tpy of Dy |



Metal ingots

» World's Most Environmentally Sustainable Rare Earth Processing Facility

SRC will solely operate the commercial demonstration facility at the highest environmental standards and we own all the necessary permits. There will be zero liquid discharge from the Facility.



Tailings Management

SRC has years of scientific, technical and management knowledge dealing with tailings, as well as experience working with regulators, communities, Indigenous groups and industry. Our capabilities in this area also include holding licences from the Canadian Nuclear Safety Commission (CNSC), as well as expertise at our Pipe Flow Technology Centre™ and through our remediation project in northern Saskatchewan that involves managing tailings remediation work at a large abandoned uranium mine site.

Environmental Compliance

- SRC works closely with its clients and stakeholders to explore opportunities and develop sustainable solutions for now and in the future. We are committed to providing positive environmental impacts in our province and around the world through diverse projects and initiatives.

For more than 60 years, SRC has actively engaged with the uranium and nuclear industry on numerous fronts. Our work has encompassed research to improve analyses and processes, project management and on-the-ground operational support.



» SRC Services for REE Sector Growth and Expansion

Technoeconomic Evaluation of Rare Earth Processing Technologies

SRC has decades of experience in technoeconomic evaluation of rare earth technologies related to beneficiation, hydrometallurgy, separation and metal smelting.

We offer a stage-gated, fast-to-fail approach and bench and pilot-scale platform for technology and process testing.

Solvent Extraction: Pilot-Scale Studies

SRC has built a small-scale separation pilot plant that has 150 stages of mixers and settlers (each stage capacity of ~1 litre) and can be configured to different separation processes for either group separation or individual REE separation. Products with +99.9 per cent purity have been produced from the pilot plant. It can be further upgraded to higher purity with an increased number of stages.

SRC has also built a commercial-scale Solvent Extraction Unit that has six



stages of mixers and settlers (each stage capacity of ~1,200 litres) and is used to improve the impeller design, process control, and mixing and separation efficiencies. These cells are designed for a 1,500 tonnes per/year separation plant.

However, SRC can design, fabricate and install solvent extraction cells at any commercial scale and conduct solvent extraction performance testing and optimization.



Metal Smelting: Pilot-Scale Studies

SRC offers an industrial-scale rare earth metal smelting pilot plant. The electrolytic furnace, with Tungsten cathode and graphite anode, has a capacity of ~43 tonnes per year and operates up to 4,000 Amps and 15 Volts.

This pilot is used to refine the operating parameters, process sequence and operating procedures to yield the highest rare earth metal recovery and purity. The unit is also used to train the operational staff and as a platform to conduct research and development for automation of the metal smelting process.

REE Plant Operational Improvement and Support

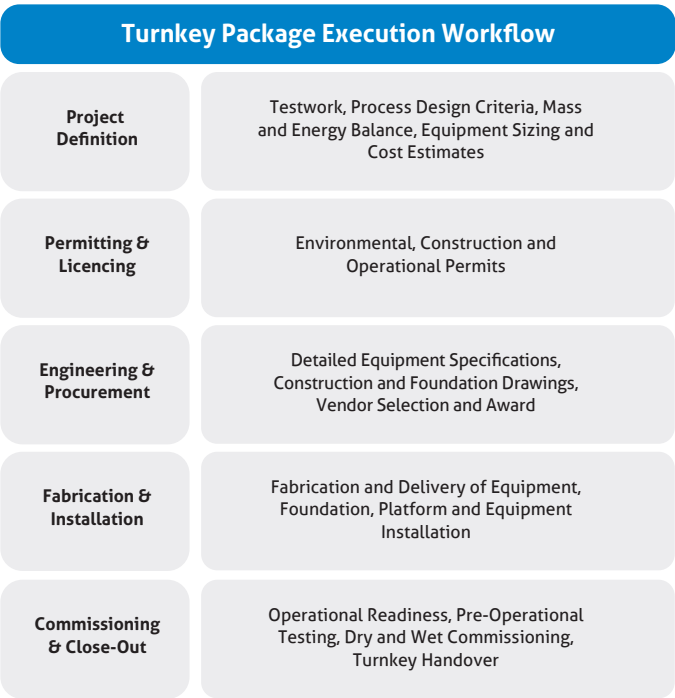
SRC can provide experienced engineers and technologists who have a broad knowledge of REE process plant development and specification to support plant operations with an objective to achieve business benefits, such as reducing production costs, improving quality and increasing throughput.

We can provide support in developing pre- and post-commissioning procedures, safe work practices and standard operating procedures, dry and wet commissioning, plant inspection and operations, operation improvements, quality management, analytical testing, and process safety.

Turnkey Services for Commercial-Scale Rare Earth Processing Facilities

SRC has a diverse team of mechanical and electrical engineers, as well as in-house fabrication capabilities with experience in engineering and designing processes, tools, instrumentation, and equipment relevant to rare earth upstream, midstream and downstream processing facilities.

SRC works closely with the local construction industry to deliver turnkey services for beneficiation, hydrometallurgy, solvent extraction and metal smelting processing.



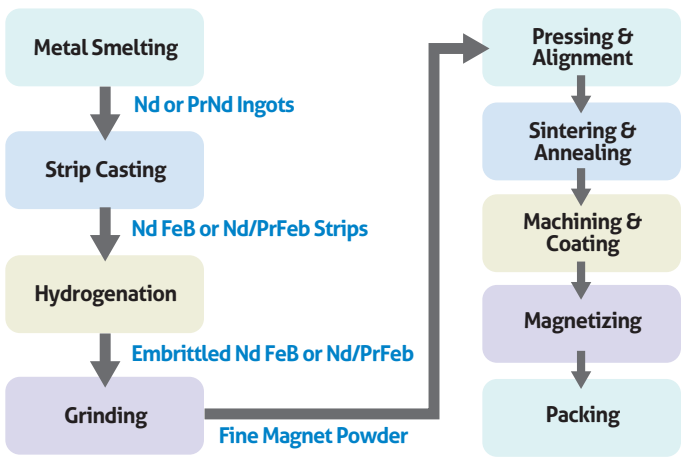
Mineral Analysis

SRC is Saskatchewan’s most advanced and complete mineral analysis centre supporting resource industries. We have the necessary analytical tools, expertise and experience to provide you with a wide range of services and analytical packages.

Our labs and experts are focused on providing leading-edge research, development and demonstration, as well as analytical services to support companies, consultants, researchers and governments with mineral exploration, mineral processing, tailings management and reclamation and decommissioning.

Platform to Start Permanent Magnet Manufacturing

SRC’s commercial demonstration facility, state-of-the-art lab and pilot-scale facilities, highly skilled team of professional engineers and technologists, and decades of experience in the rare earth sector offer a great opportunity to initiate a permanent magnet manufacturing facility in Saskatchewan.



We offer a research and development platform to conduct pilot-scale projects leading to process and control and engineering design of economically viable commercial-scale downstream facilities, from rare earth metals to permanent magnets.

Environmental Permitting

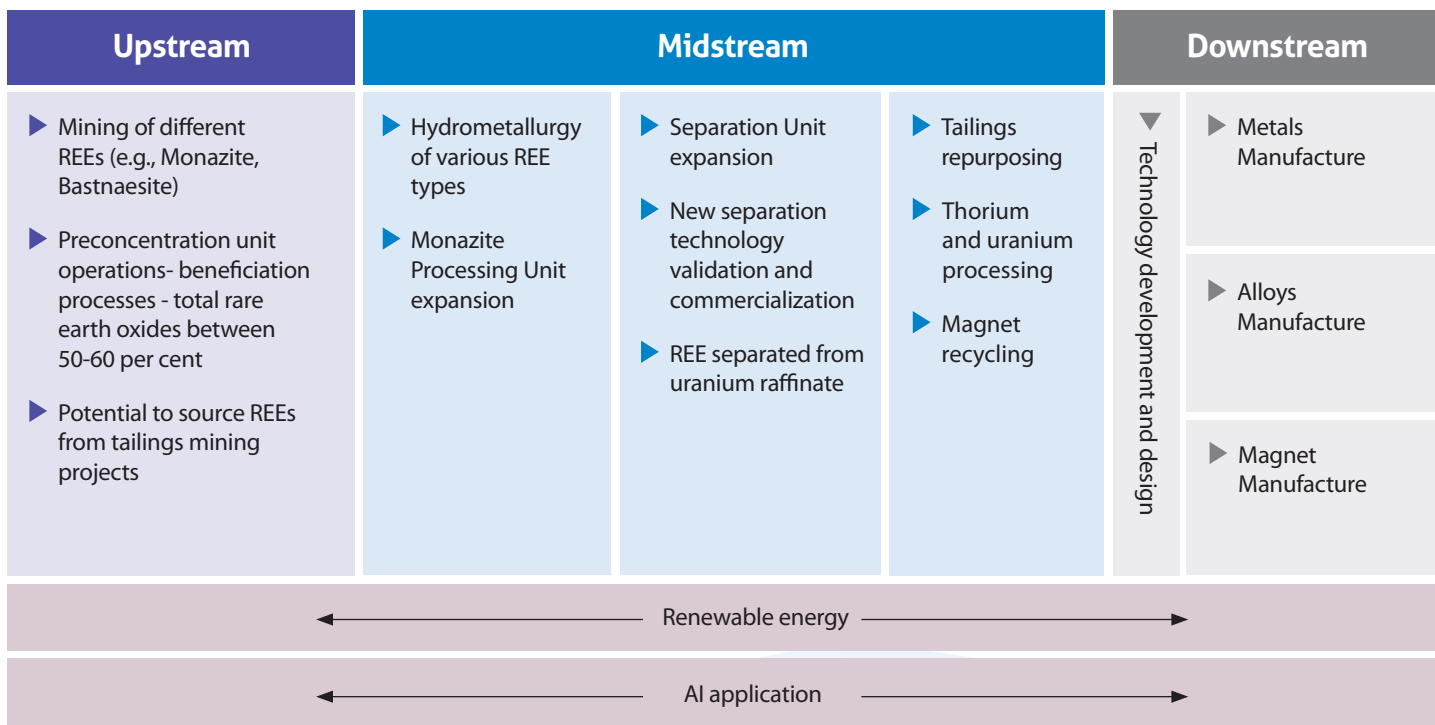
We work with our clients to develop detailed tailings management, environment emission control and operational planning to support the environmental permitting and licensing process.

› SRC Collaboration Opportunities

In the future, SRC will be seeking investment into further developing and expanding the critical minerals sector.

SRC offers a fee-for-service model that provides services and expertise to clients for a fee.

- ▶ As a Treasury Board Crown Corporation, SRC works closely with the Government of Saskatchewan, including the Ministry of Trade and Export Development, the Ministry of Energy and Resources and the Ministry of Environment. SRC can help facilitate communications between the private sector and the Government of Saskatchewan for licensing and permitting, funding opportunities and investment credits.
- ▶ Over the past 75 years, SRC has built strong relationships within the mining sector in Canada and Saskatchewan. We are working closely with the burgeoning rare earth mining industry in Saskatchewan to help develop this emerging sector.
- ▶ SRC protects any intellectual property it develops on its own or as required for its clients. This may include copyrights, patents and trade-secret information. SRC and its employees will not knowingly infringe upon the intellectual property of an organization or individual. Intellectual property is covered under a standard clause as part of client agreements and negotiated on a case-by-case basis.



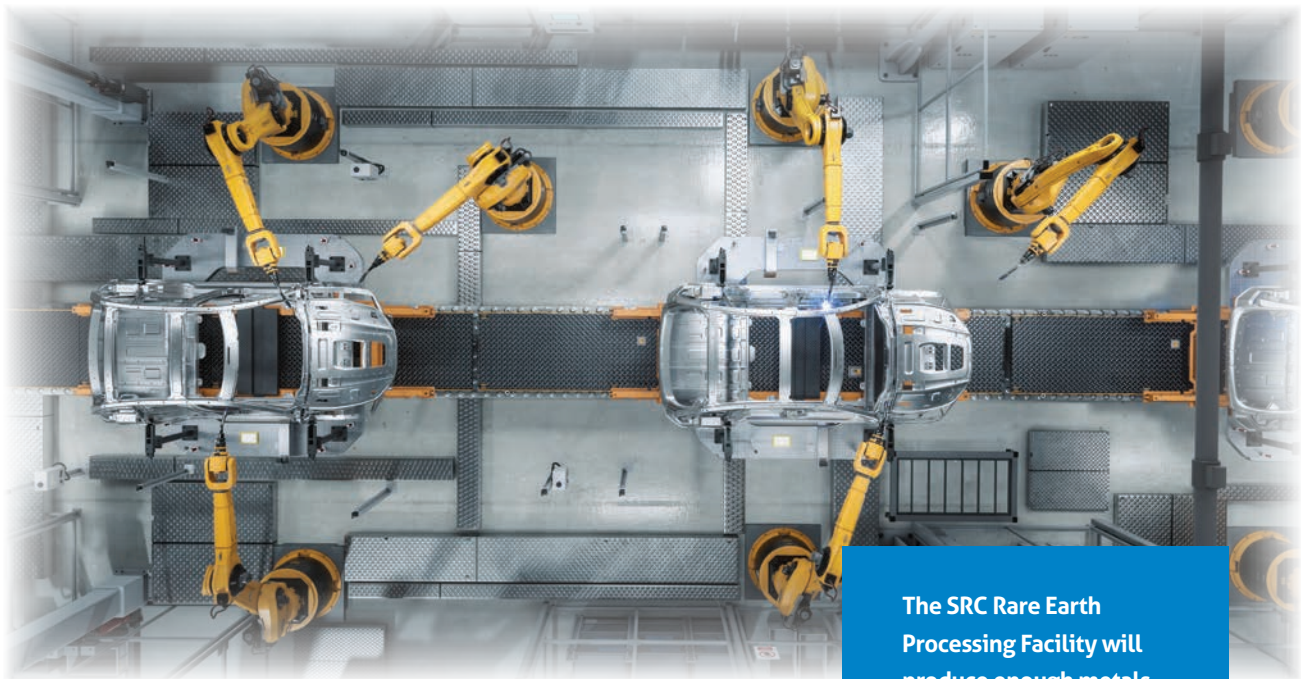
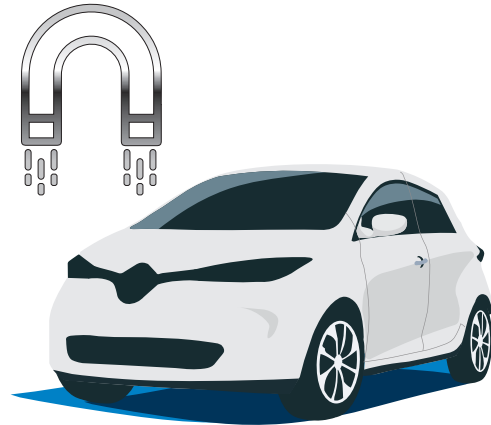
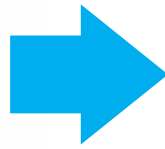
Completing the Strategic Supply Chain

- ▶ After a successful test run of its metals smelting unit, the under construction SRC Rare Earth Processing Facility became the first large-scale producer of magnet metals in Canada.

- ▶ Metal ingots, a rare earth metal, are the key ingredient used to manufacture permanent magnets which are used in electric vehicles, wind turbines, electronics, etc.



Metal ingots



The SRC Rare Earth Processing Facility will produce enough metals to create 300,000 electric vehicles annually.



For more information please visit:

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