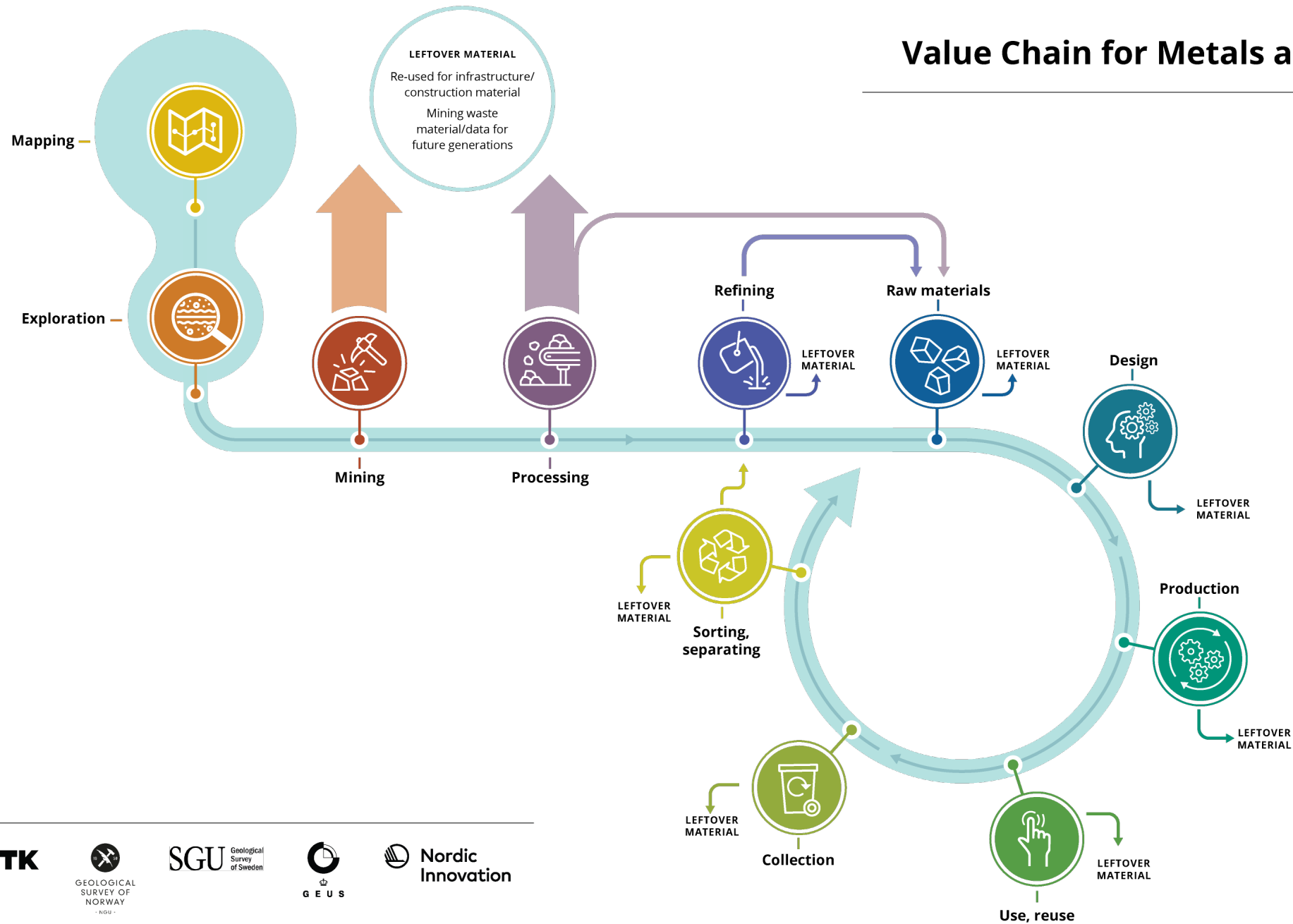


Value Chain for Metals and Minerals





Mapping and Exploration

Mapping

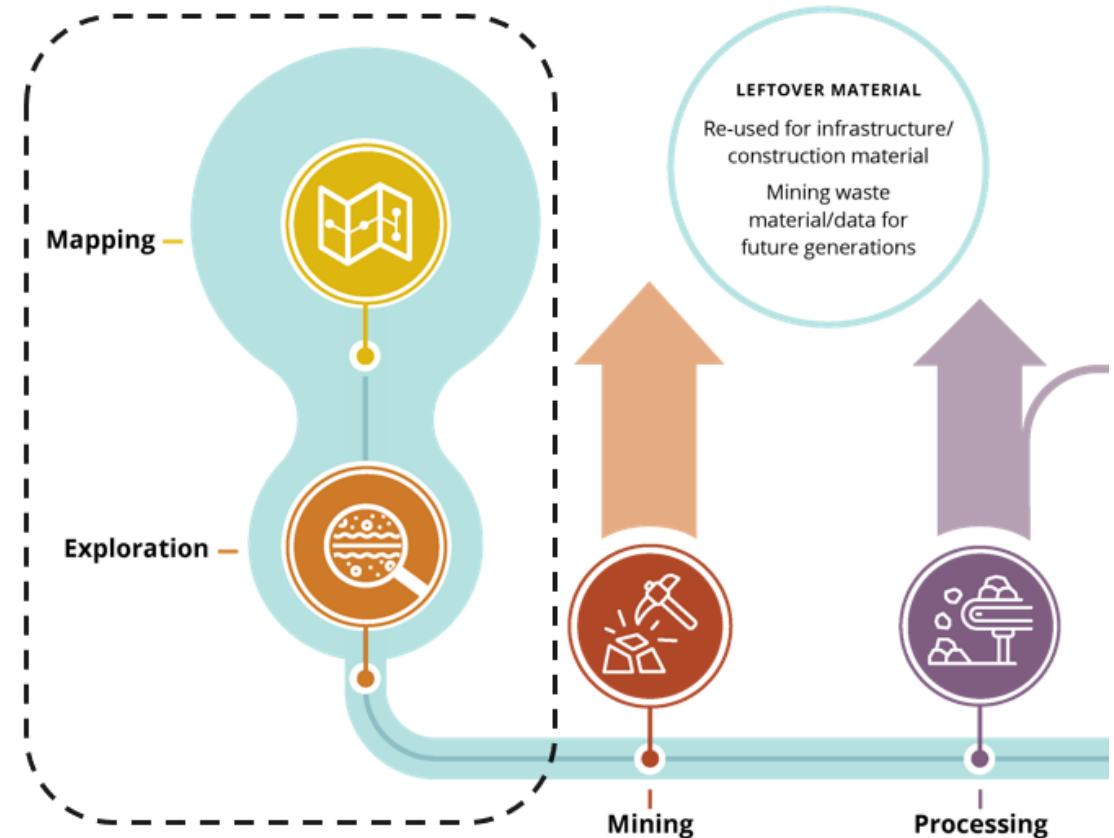
Finding and documenting a mineral deposit is time-consuming. This is usually done by National geological surveys. They provide publicly owned geological data from mapping to reduce economic risk for private companies and minimize environmental impact.

Exploration

Exploration is targeted activities based on the mapping. It includes a range of activities to help determine the commercial viability of the mineral deposits.

Only a small number of the mapped and explored deposits goes forward to the mining phase.

The data from both mapping and exploration phases serves the future generations' needs also.





Mining, Processing and Refining

Mining

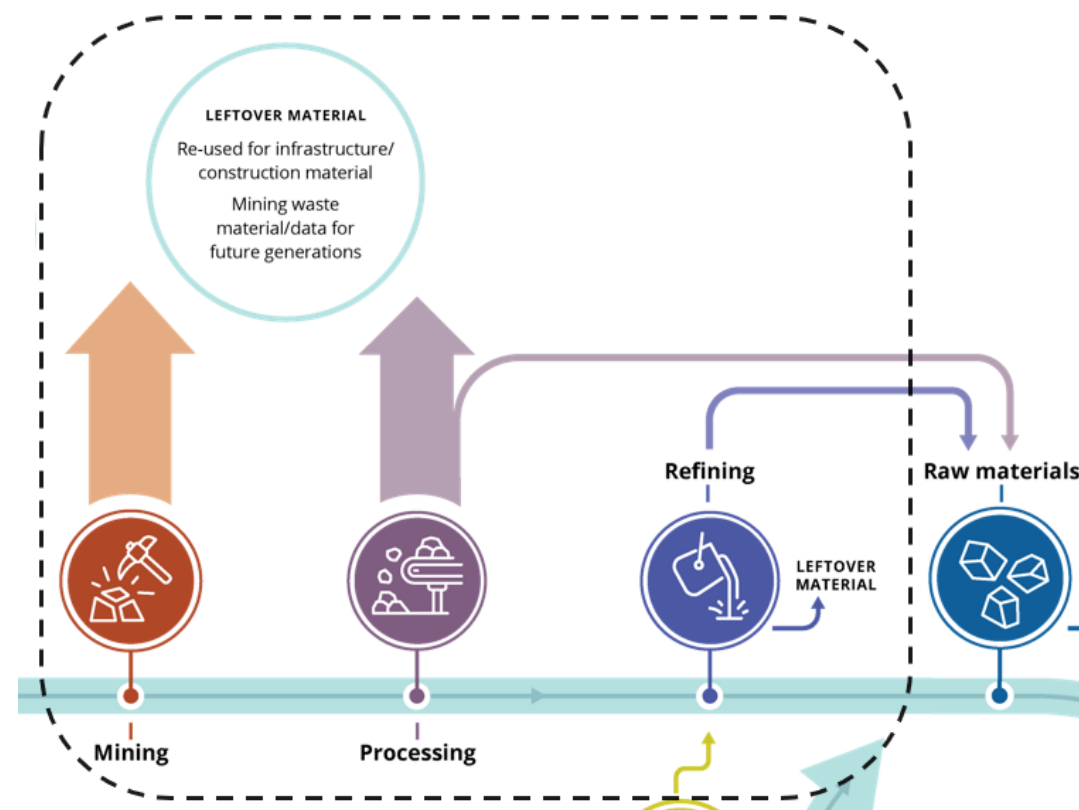
In the mining, the minerals and metals are extracted from the bedrock. Mining processes involve prospecting for ore bodies, analysis of the profit potential of a proposed mine, extraction of the desired minerals and metal, and final reclamation or restoration of the land after the mine is closed.

Processing

Crushing, grinding, and treating extracted ores to separate valuable minerals and metals from the ore.

Refining

Purifying extracted minerals to obtain high-purity products suitable for industrial applications (metallurgy).





Then the mining is done in such a precision that the fractions are kept separated. This is more time-consuming but pays off at the later phases in the value chain.

-
- The diagram illustrates a circular economy for mining and processing. It features a horizontal timeline with four stages: Mining, Processing, Refining, and Raw materials. Mining and Processing are enclosed in a dashed oval labeled 'LEFTOVER MATERIAL'. Mining produces waste re-used for infrastructure. Processing produces waste re-used for construction material. Refining produces waste re-used for mining waste material/data. Raw materials are produced from refined materials. Arrows show the flow of materials and waste between stages.
- LEFTOVER MATERIAL**
Re-used for infrastructure/
construction material
Mining waste
material/data for
future generations
- Mining**
- Processing**
- Refining**
- Raw materials**
- LEFTOVER MATERIAL**



Raw materials, Design, Production

Raw materials

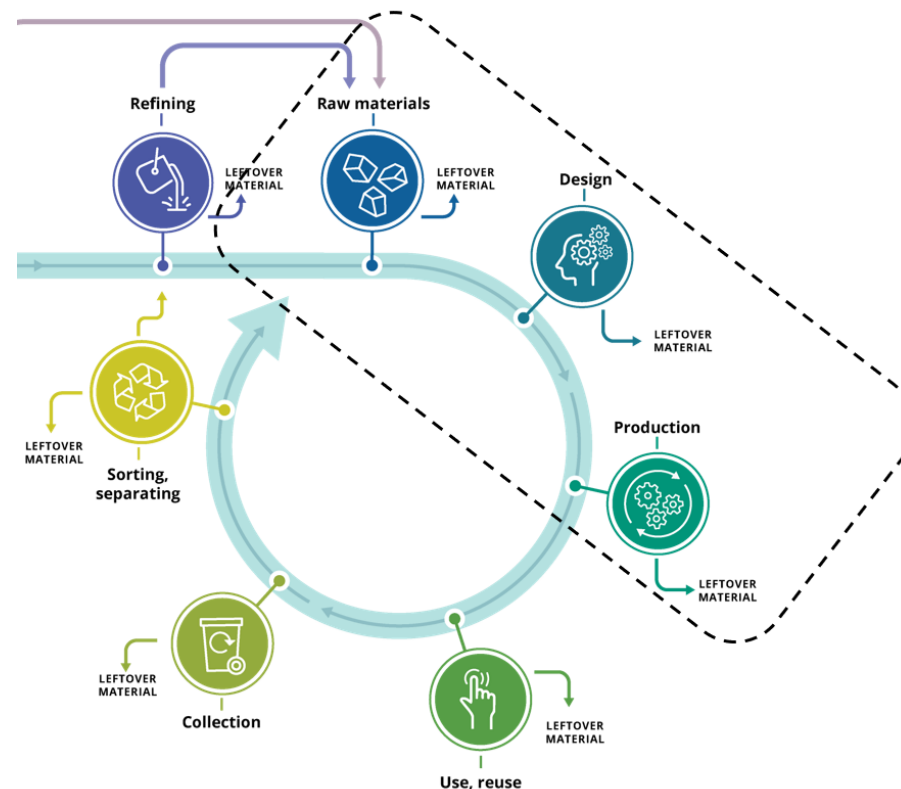
After refining the metals and minerals they are raw materials for design, manufacturing and production.

Design

Design phase is crucial for the circularity in the next steps of the value chain. In circular design products are designed for long usability, repairability and recyclability.

Production

Manufacturing products using metals and minerals as key components in various industrial processes.





Use & reuse, Collection, Sorting & Separating

Use / reuse

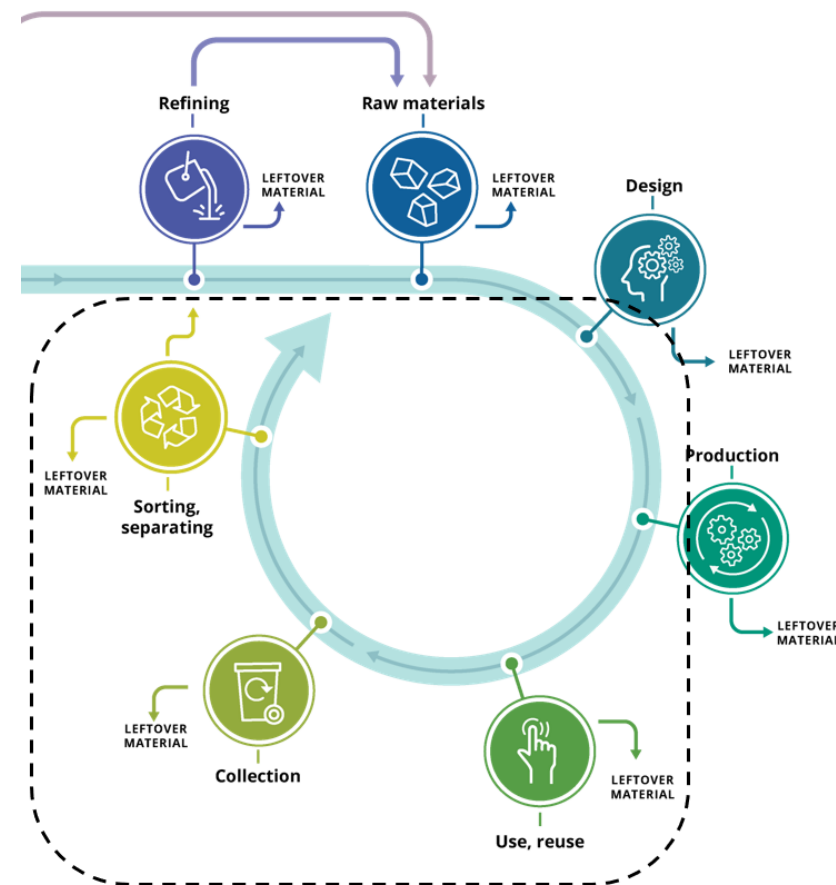
Utilizing manufactured products in consumer or industrial applications and extending their lifecycle through repair, reuse or repurposing.

Collection

Gathering end-of-life products or waste materials containing minerals for recycling or disposal.

Sorting

Separating collected materials based on type, quality, and potential for recovery of valuable minerals.



Leftover materials | Reducing waste – maximising value

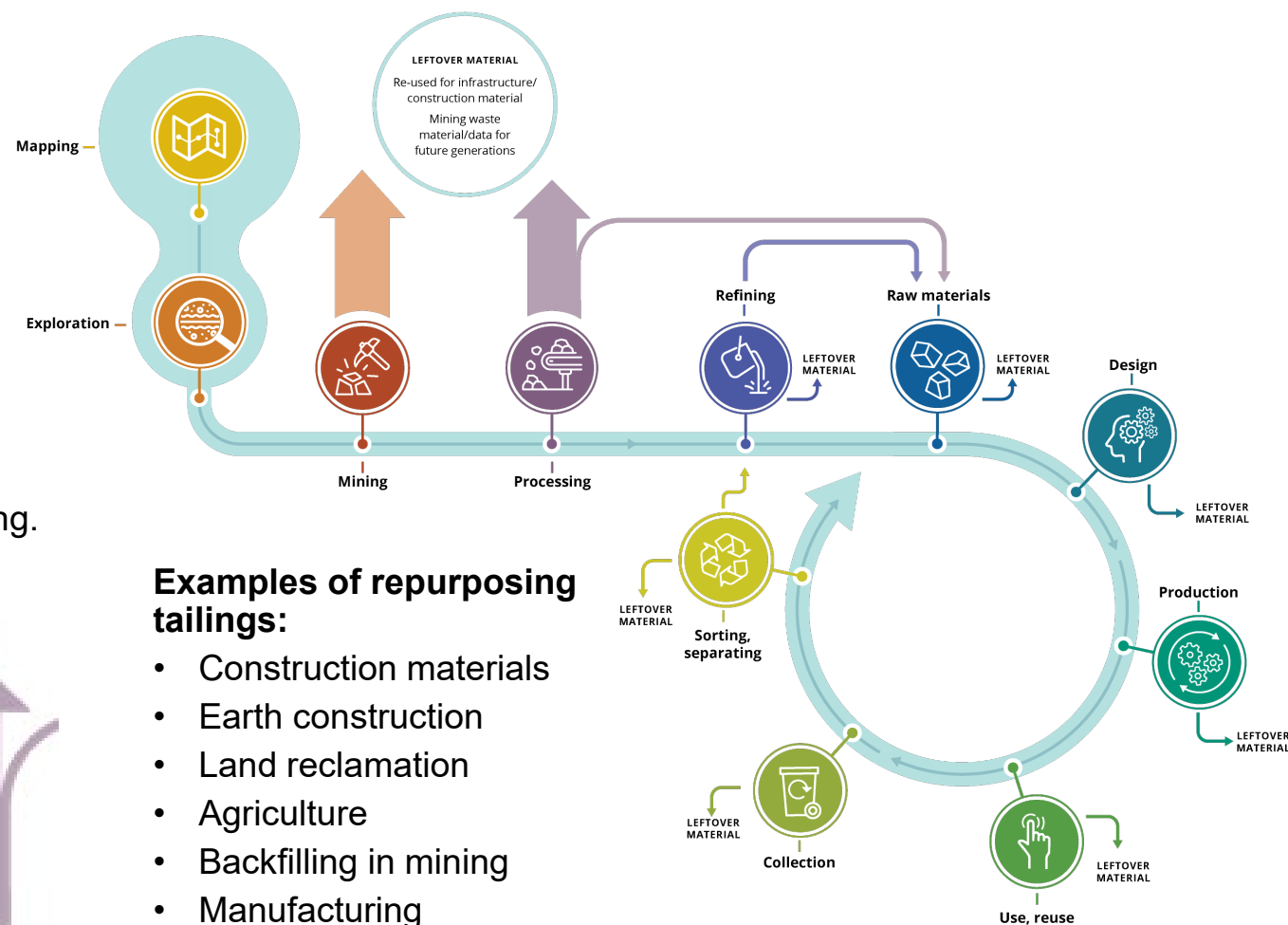
Leftover materials are created in all the value chain phases.
The biggest leftover material flow is from mining and processing.

Repurposing leftover materials

- reduces the need for deposits and virgin materials
- minimizes environmental impact
- is both resource-efficient and economically beneficial.

It decreases the waste management costs and its spatial footprint.

Design-based circularity utilises the material in the value chain and decreases the amount of the leftover material.



Examples of repurposing tailings:

- Construction materials
- Earth construction
- Land reclamation
- Agriculture
- Backfilling in mining
- Manufacturing
- Water treatment of industrial wastewater
- Energy production
- Recovery of valuable minerals and companion metals/minerals (secondary resources)

Nordic Sustainable Minerals project



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