FINNISH MINERALS GROUP

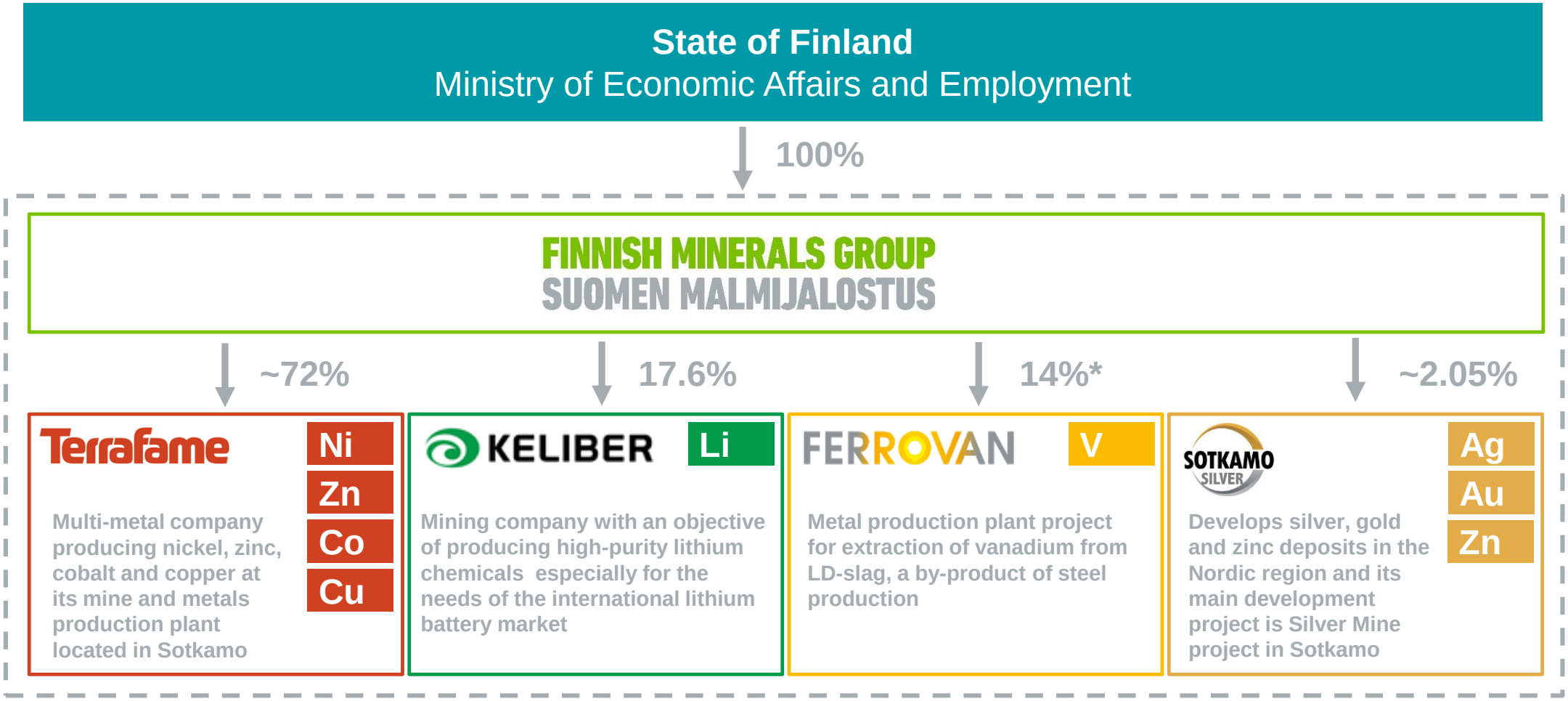
Responsibly maximizing the value of Finnish minerals

CEO Matti Hietanen

Future Mine & Mineral, January 29th, 2019, Stockholm

Introduction to Finnish Minerals Group, its strategy and operations

Finnish Minerals Group is a special-purpose development company owned by the State of Finland



* Through a convertible loan

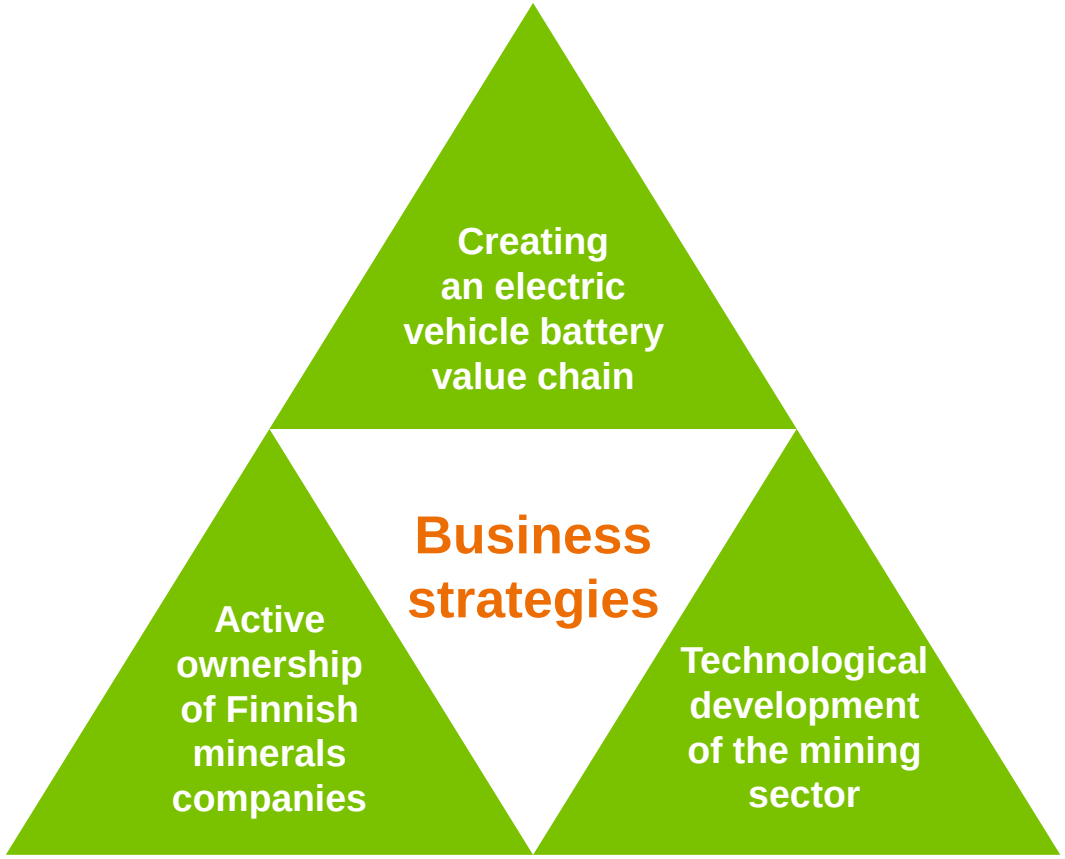
Strategy

Mission

Responsibly maximizing
the value of Finnish minerals

Vision

We will bring active and competent capital to a technologically advanced mining industry. We will create an integrated electric vehicle battery value chain in Finland.



Portfolio Companies

Terrafame Ni Co Zn Cu

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Overview

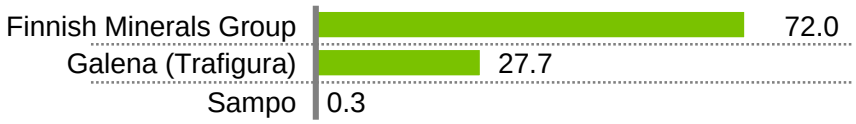
Terrafame Oy is a multi-metal company producing nickel, zinc, cobalt and copper at its mine and metals production plant located in Sotkamo

+ Terrafame employs approximately 650 skilled professionals and has a network of 630 partner employees working regularly at the site
+ In the first half of 2018, Terrafame produced record levels of its main products: 12,341 tonnes of nickel and 29,104 tonnes of zinc
+ In the third quarter of 2018, Terrafame reached positive free cash flow after sustaining CAPEX

Terrafame has recently made the decision to invest in a battery chemicals plant that will produce nickel sulfate and cobalt sulfate

Year founded:	2015
Headquarters:	Sotkamo, Finland
Company type:	Private company
Life of mine:	Over 30 years
Chairman of the Board	Lauri Ratia
CEO:	Joni Lukkaroinen
Revenue (2017):	EUR 220 million
EBITDA (2017):	EUR 14 million

Ownership, %, December 31 2018



Company timeline

2015 Terrafame to restart operations of the Sotkamo mine – mine's business transaction finalized

2016 Ramp-up progresses according to plan

November 2017 Planning of nickel and cobalt chemicals production for battery applications

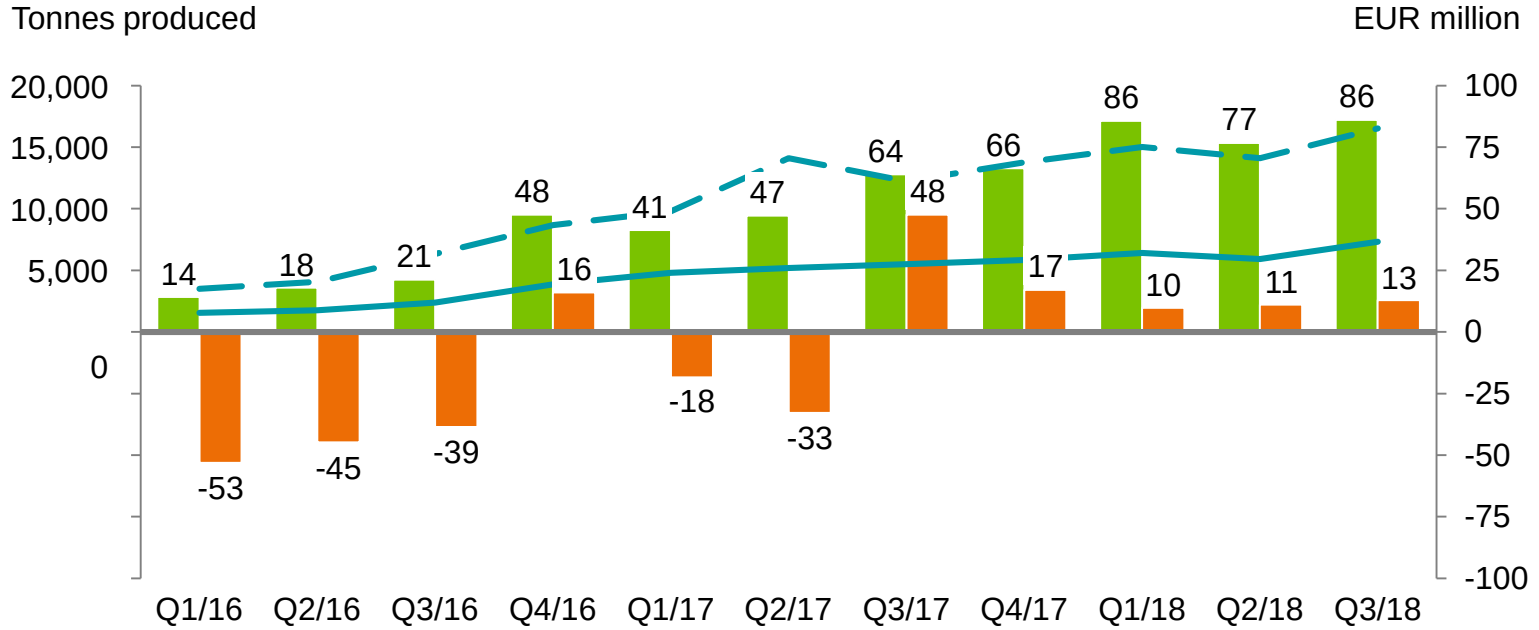
March 2018 Battery chemicals plant progresses to EIA

July 2018 Building permit for battery chemicals plant granted

2020 Battery chemicals plant construction complete

2021 Commercial production of battery chemicals to begin

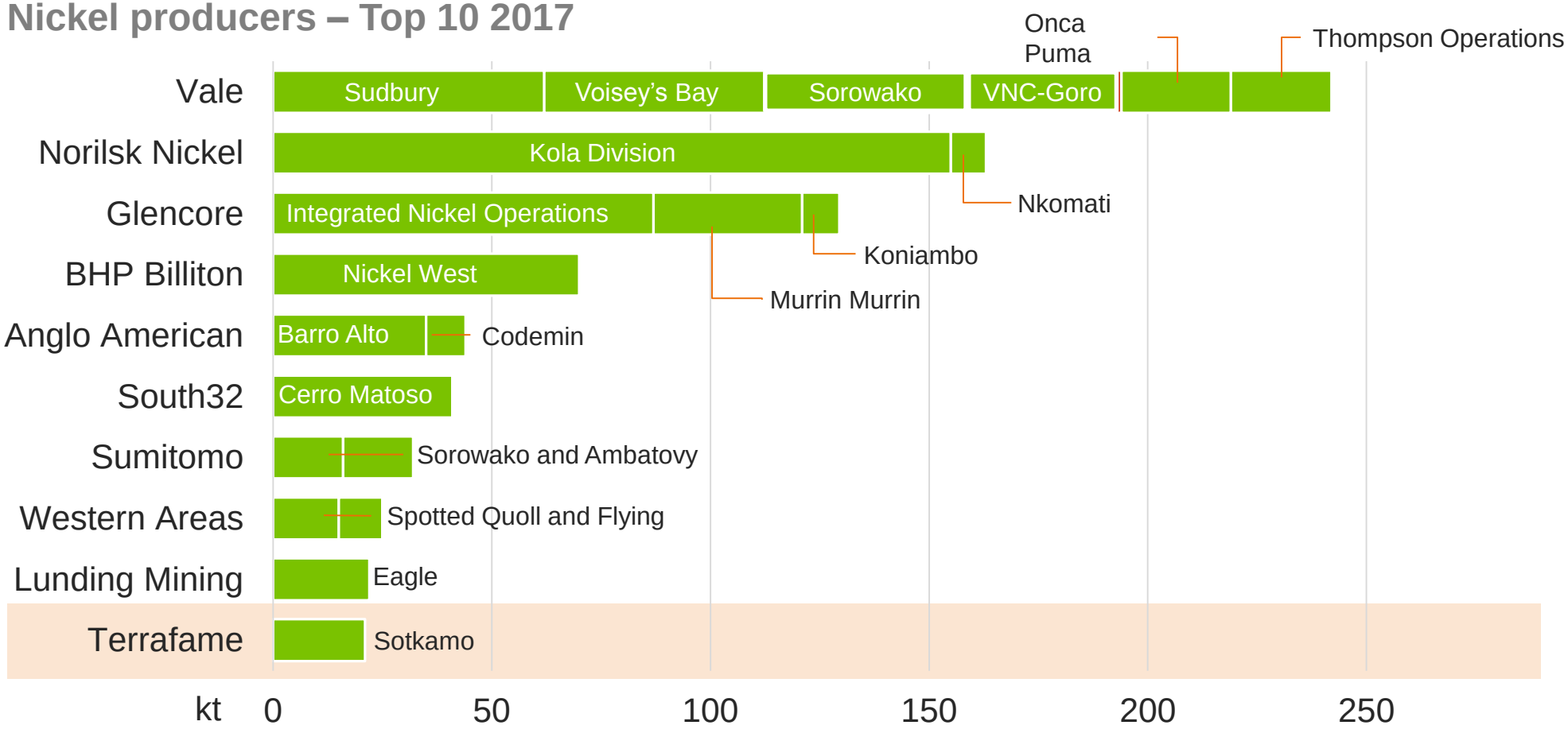
Quarterly operating KPI



Sources: Company website

Terrafame is a global top-ten player in the nickel mining industry

Nickel producers – Top 10 2017



Source: Michael Allan McCrae, mining.com 2018 ja Mining Intelligence Data

Terrafame Ni Co Zn Cu

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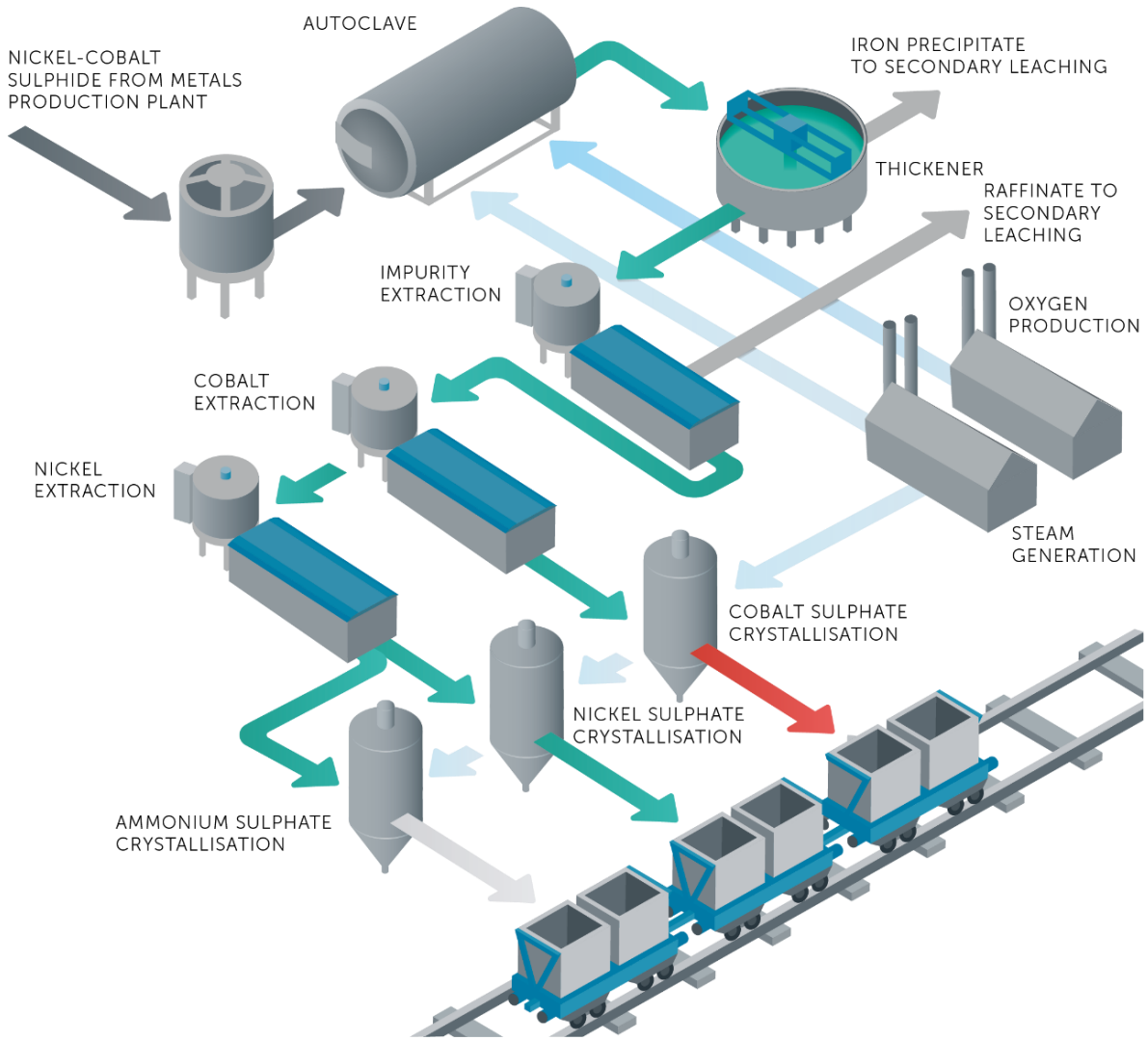
Terrafame is aiming at becoming a significant producer of battery grade chemicals

- Value of the battery chemicals plant investment is EUR 240 million.
- Planned production capacity:
  - Nickel sulphate for EV batteries 170,000 t/a
  - Cobalt sulphate for EV batteries 7,400 t/a
  - Ammonium sulphate as fertilizer 115,000 t/a
- The production will be started at the beginning of 2021.
- According to our estimate, the new plant will increase the company's net sales by appr. EUR 200 million annually.



KELIBER Li

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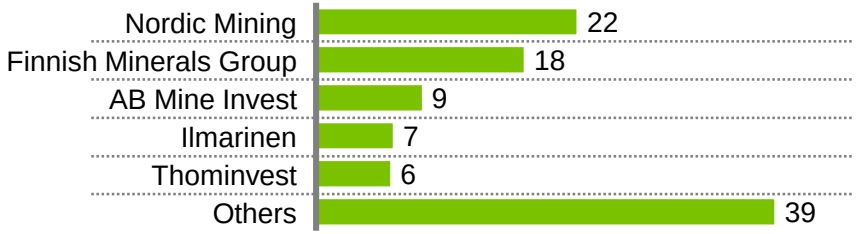
Overview

Keliber is a Finnish mining company with a target of producing high purity lithium chemicals especially for the needs of the international lithium battery market

- \+ Valid mining licence for a deposit situated in Länttä, Kokkola, as well as several exploration permits and claims on other deposits
- \+ Spodumene ore processing in Kaustinen and refining of spodumene concentrate to lithium chemicals in Kokkola
- \+ Possibility to refine purchased concentrate
- \+ The most advanced lithium project in Europe
- \+ Project can be extended to 20 years by purchasing spodumene concentrates from third parties

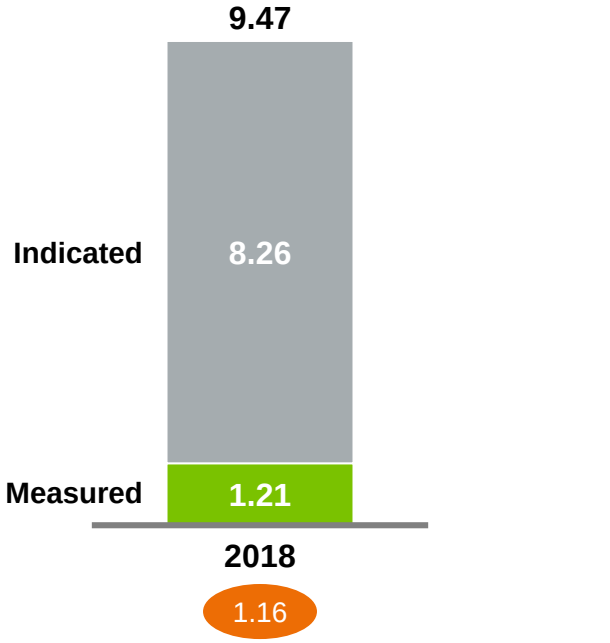
Year founded:	2001
Headquarters:	Kaustinen, Finland
Company type:	Private company
Life of mine (operation):	13 years (+7 years)
Chairman of the Board:	Esa Tikka
CEO:	Lamberg, Pertti

Ownership, %, November 16 2018

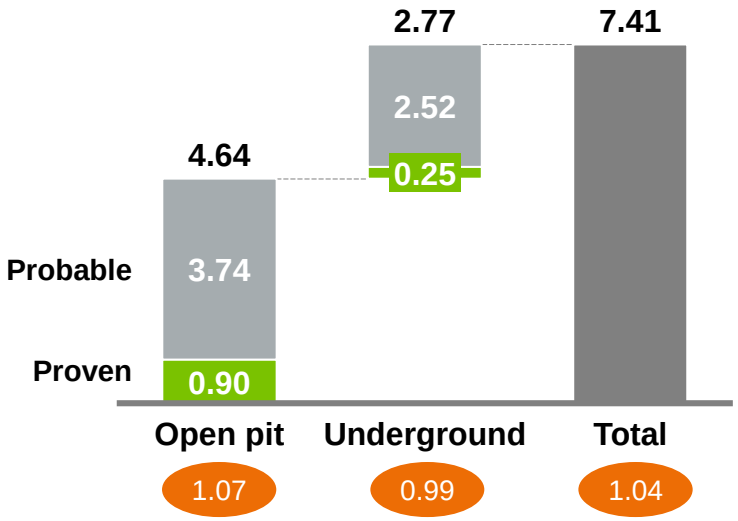


Project timeline

Resources, mil. metric tonnes



Reserves (2018), mil. metric tonnes



Sources: Company website

Overview

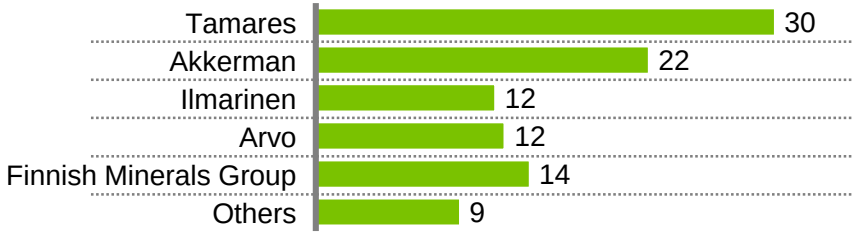
Ferrovan Oy aims to construct a metal production plant for the extraction of vanadium from LD-slag, a by-product of steel production

- The recycling plant will be built at the port of Raahe in Finland
- Slag to be sourced from SSAB steel plants
- Provides an environmental solution for large steel slag piles and produces clean slag for the construction and cement business

Ferrovan also owns exploration rights at Mustavaaran kaivos

Year founded:	2011
Headquarters:	Raahe, Finland
Company type:	Private company
Chairman of the Board:	Mika Seitovirta
CEO:	Pitkäjärvi, Jukka

Ownership (fully diluted), %, November 16 2018



Project timeline

Sources: Company website

SOTKAMO SILVER | Ag | Au | Zn | Pb

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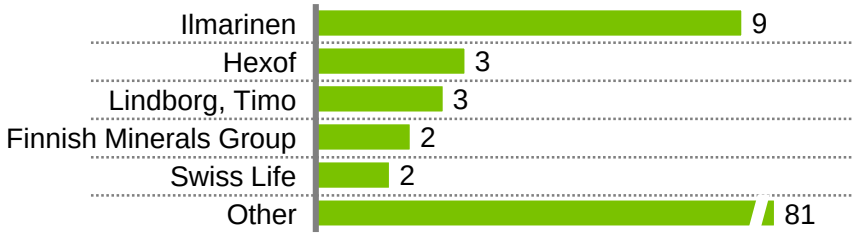
Overview

Sotkamo Silver AB is the parent company of Sotkamo Silver Group, which consists of the parent company and its wholly-owned subsidiary in Finland, Sotkamo Silver Oy

+ Sotkamo Silver develops silver, gold and zinc deposits in the Nordic region and its main development project is Silver Mine project in the municipality of Sotkamo
+ Sotkamo Silver is currently constructing a Silver Mine, planned to be in production during early 2019

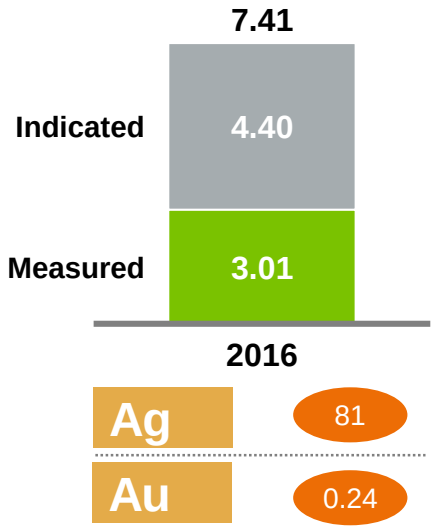
Year founded:	2010
Headquarters:	Stockholm, Sweden
Company type:	Public company
Life of mine:	6 years
Chairman of the Board:	Mauri Visuri
Management:	Lindborg, Timo

Ownership, %, as of October 31 2018

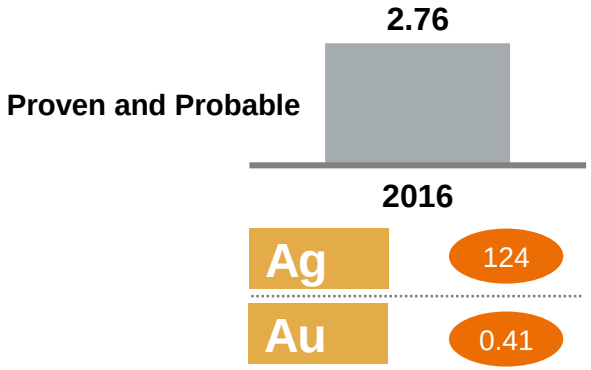


Silver Mine project timeline

Resources, mil. metric tonnes x Grade, g/t



Reserves, mil. metric tonnes x Grade, g/t



Sources: Company website


Research and Development

R&D develops portfolio companies, provides technical support for other business areas and advances industrial renewal

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A Process improvement projects for our portfolio companies, including technology evaluation and other R&D services

B Technical support for FMG investments and EVB business areas

C Facilitator activities as well as participation in long-term R&D programs

We are actively involved in industry-relevant communities nationally as well as on EU level. This gives access to state-of-the-art development when exploring the future opportunities in battery value chain.

Examples of the projects

Nemo

EU H2020 IA project targeting the near-zero-waste recycling of low-grade sulfidic mining waste. For us, a key factor is the multi-actor technical approach to improve Terrafame's existing processes and investigate new opportunities for future products.

Horizon 2020
European Union Funding
for Research & Innovation

SO4 Control

EIT RawMaterials project focusing on enhancing of leaching performance and innovative sulfate reduction. Provides an opportunity to boost Terrafame's operations and is part of our commitment to environmentally and financially sustainable solutions for mining.

eit RawMaterials

BatCircle

R&D consortium project financed by **Business Finland** targeting Battery Metal Ecosystem generation to Finland.

BUSINESS FINLAND

Battery Alliance

European Battery Alliance (EBA) strives to create a competitive manufacturing value chain in Europe with sustainable battery cells at its core.

Battery operations

EVs are becoming more common in traffic

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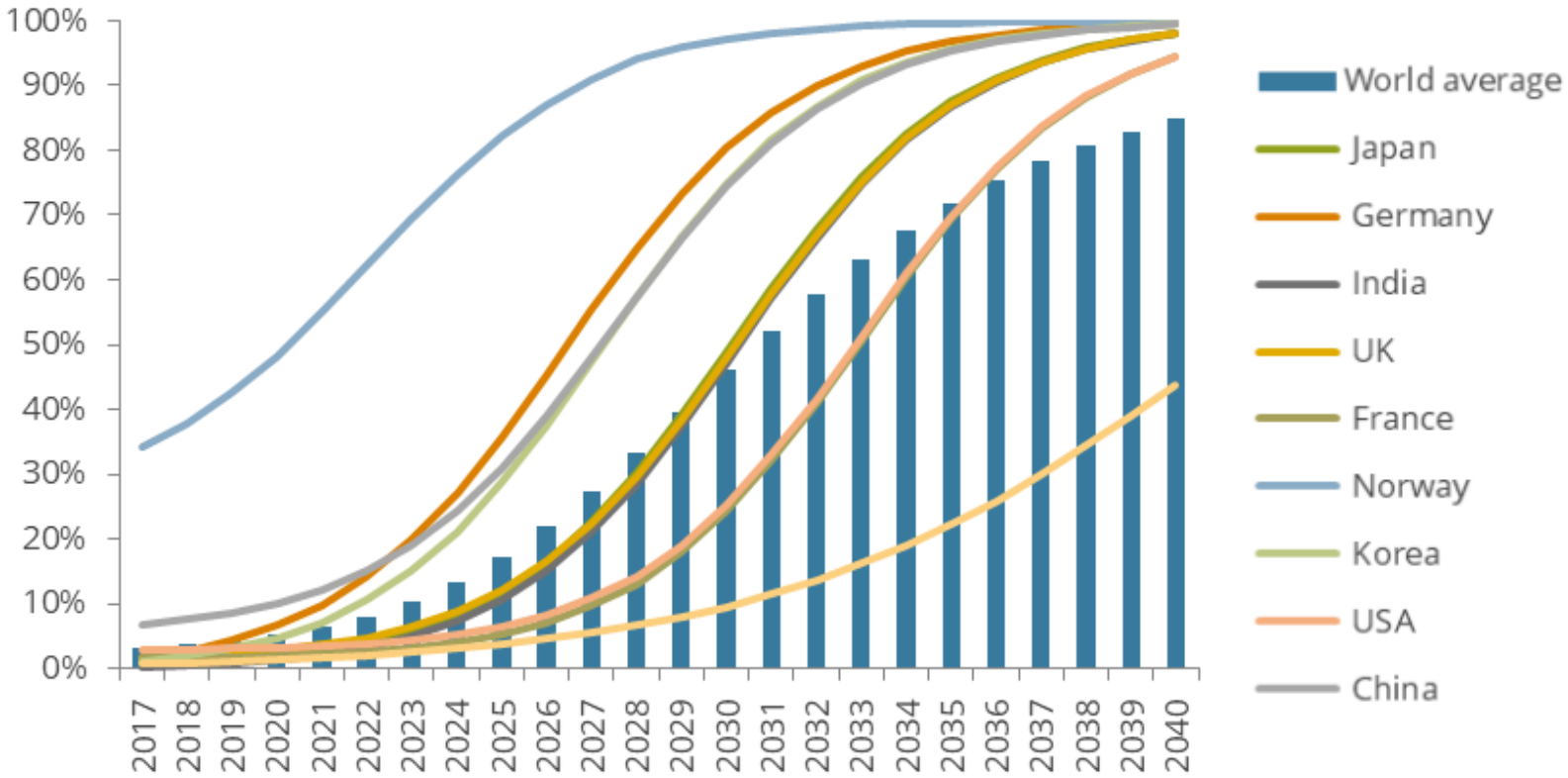
Outlook for deep electrification, 2017–2040

PHEV, FCEV, LSEV and BEV sales as % of total



Source: Roskill, 2018

PHEV = Plug-in hybrid electric vehicle, FCEV = Fuel cell electric vehicle

LSEV = Low Speed Electric Vehicle, BEV = Battery electric vehicle

Market for rechargeable batteries is growing rapidly – automotive by far largest growth segment

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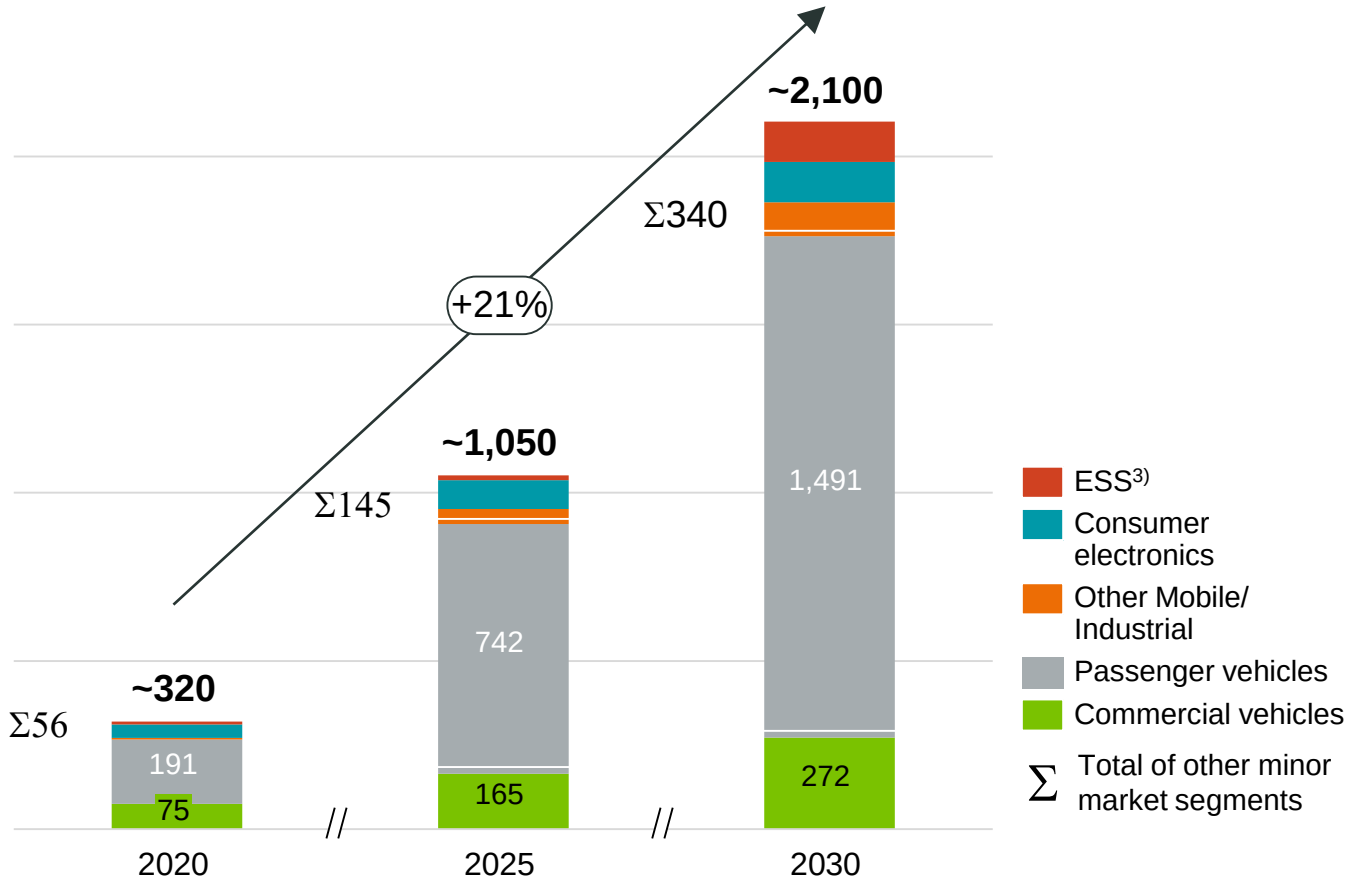
Future state – LiB market forecast [GWh]



Comments

> LiB will surpass all other chemistries around 2025
> Automotive will be the most important growth driver, accounting for >80% of the rechargeable battery market in 2025.
> Other areas with specific requirements will grow to potentially attractive “niche” markets (esp. ESS2))
> Fuel cells might take over some LiB shares after 2025

Note: Commercial Vehicles (CV: trucks, bus, LCV), cars (PV = Passenger vehicles, SV = shared vehicles) ESS = Energy Storage Systems 3) Mainly automotive

Source: Avicenne; Fraunhofer; Expert interviews; Roland Berger

Mobility transformation is expected to significantly increase demand for resources

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For producing each electric vehicle, we need:	Today[1]	Tomorrow[2]
	36 kilograms of nickel	52 kilograms of nickel
	7.4 kilograms of lithium	8.4 kilograms of lithium
	12 kilograms of cobalt	6.6 kilograms of cobalt
	~$1,400 per car[3]	~$1,200 per car[3]

1 Considering an NMC622 cathode, 55 kWh battery pack

2 Considering an NMC811 cathode, 77 kWh battery pack

3 At Q2 2018 prices

SOURCE: 2017 Battery raw materials demand model 2018Q1

Finland has the leading EVB material refineries and is the only source of selected minerals in Europe

Demand is expected to increase for several key materials	Finnish raw materials (annual capacity)	Further processing capability in Finland (annual capability)
Co ▪ Cobalt demand to increase by 2–2.5x by 2025 ▪ Most supply from the politically unstable DRC	Terrafame ~7 kt cobalt sulfate **~ 16 GWh i.e.** **210 – 400.000 BEVs[1)]**	Freeport Cobalt World's largest Co refinery
Ni ▪ Battery-grade nickel demand to increase by 5-6x by 2025, from 90 kt in 2016 to over 500 kt in 2025	Terrafame ~170 kt nickel sulfate **~ 51 GWh i.e.** **650 t – 1,3 mill BEVs[1)]**	NORNICKEL BASF We create chemistry Nickel raw material sourced from Russia. Nornickel & BASF co-operation.
Li ▪ Lithium demand to increase by ~4–5x by 2025, but supply likely to respond rapidly	KELIBER ~11 kt LCE[2)] **~ 20 GWh i.e.** **260 – 440.000 BEVs[1)]**	KELIBER Additional refining capacity

1 NMC811 technology, full Battery EV (BEV) battery pack range 40 – 77 kWh
2 Estimated start 2021
3 Optional start 2021

+ Secure supply of critical raw material
+ Traceable raw materials from politically stable environment
+ Largest refining capacity in Europe for Cobalt, Nickel and Lithium for batteries
+ Opportunity for long-term contracts within 1st class industrial infrastructure

FMG's assets and Finnish industry support creation of battery value chain

Freeport Cobalt

+ World's largest **cobalt refinery**

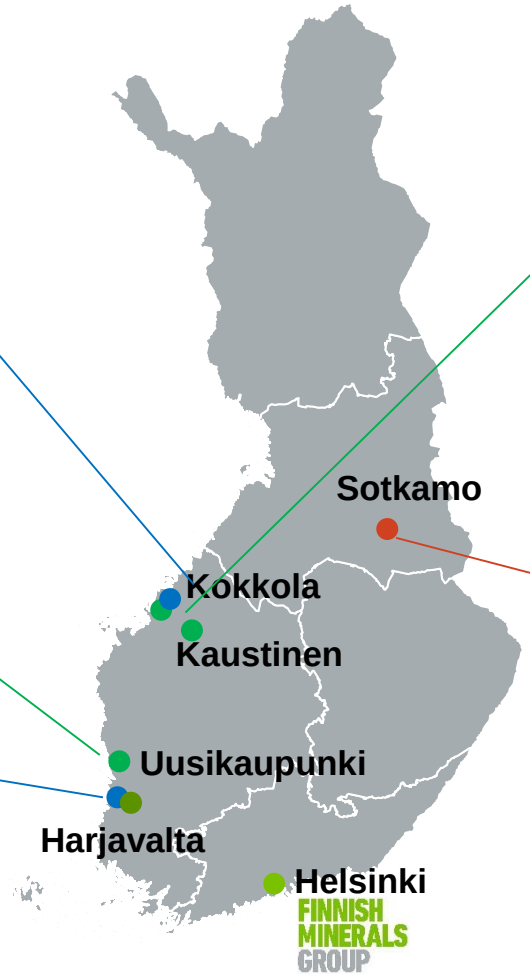
valmet automotive

+ **Valmet Automotive** is the leading contract manufacturer to Daimler. Has competence for EV production (e.g. Fisker Karma) and is currently also producing modules and packs for industrial applications.

BASF We create chemistry

NORNICKEL

+ **BASF** has selected Harjavalta as the first location for battery materials production serving the European automotive market. The plant will be constructed adjacent to the nickel and cobalt refinery owned by **Nornickel**.



KELIBER

+ **Keliber** is starting operations for **lithium mining**
+ Going to produce **battery grade lithium chemicals**

Terrafame

+ **Terrafame mines nickel, zinc and cobalt,** being one of the largest nickel producers in the world
+ Expanding into **battery grade nickel and cobalt sulfate production**

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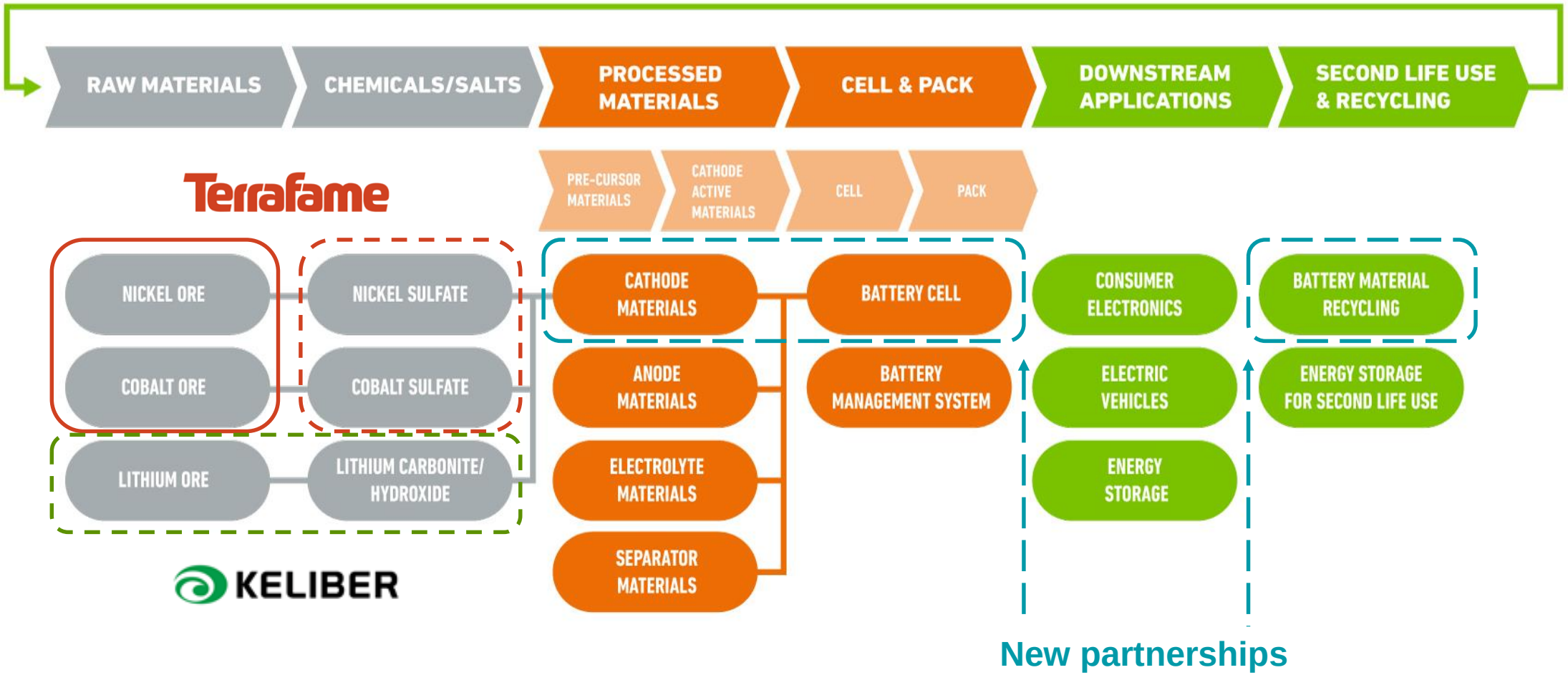
We are moving forward in the value chain



Finland is the only European country that can provide a cost efficient, sustainable EVB value chain from raw material to cell

1. Access to sustainable **RAW MATERIALS** and **MATERIALS PROCESSES CAPACITIES**

2. **REDUCED FINANCIAL RISK** and access to **FINNISH BUSINESS NETWORK** through co-investment

3. Access to **TALENT FOR ADVANCED PRODUCTION** and **RESEARCH & DEVELOPMENT**

4. Access to **SUSTAINABLE** and **RELIABLE ENERGY**

5. Attractive business conditions with **COMPETITIVE TAXATION** in globally most macro-economically stable country

We can provide speed in your European establishment

FINNISH MINERALS GROUP

Preparation and partner identification

Partner discussion, JV establishment and permitting

Investment and construction

FINNISH MINERALS GROUP
SUOMEN MALMIJALOSTUS