SWEDISH MINING INNOVATION

Jenny Greberg, Programme Director
Swedish Mining Innovation

Med stöd från
VINNOVA Sveriges innovationsmyndighet
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Sweden –long tradition and leading technology

- Small country – rich bedrock
- Large scale mining in Sweden started 900 years ago
- 60 % of the global underground equipment comes from Swedish suppliers
- The worlds most productive open pit – Aitik mine, northern part of Sweden
- The worlds most productive underground Iron ore mine – Kiruna mine, northern part of Sweden

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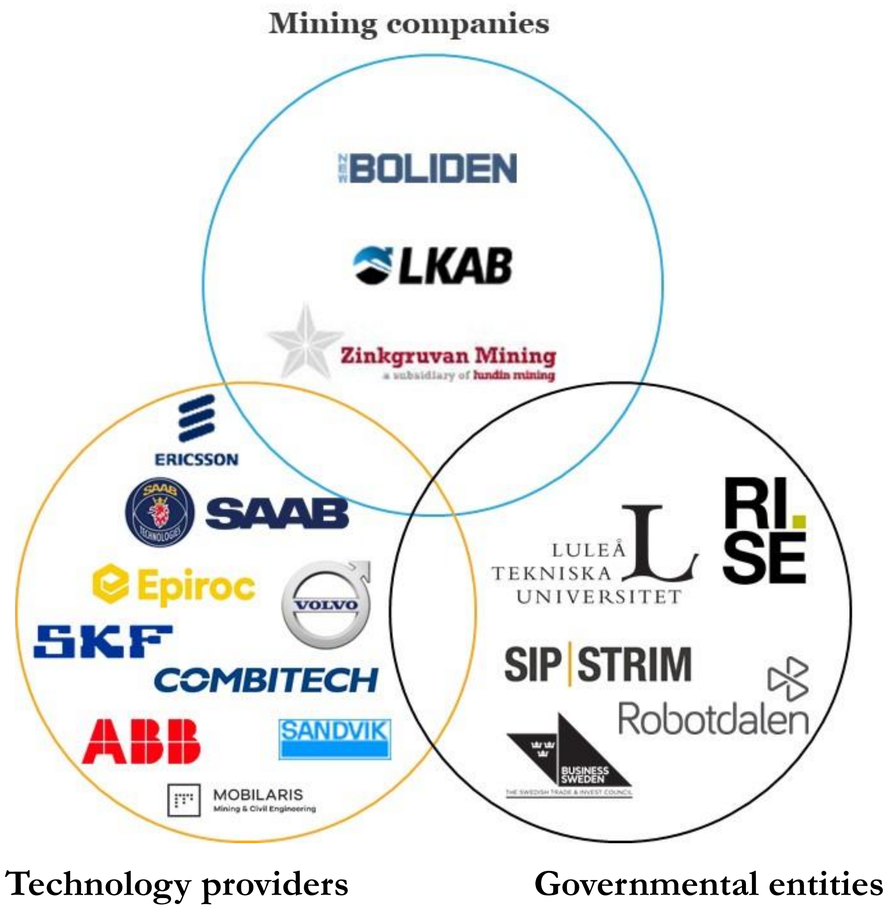
The Swedish Mining Innovation system

- Long tradition of Innovation through collaboration – strong cluster
- B2B, Public-Private-Partnerships, Triple helix (University – industries - government) etc.
- Strong National programmes with public funding supporting innovation



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National Research and Innovation Roadmap for the Mining and Metal producing Industry (2013, 2016, 2019)

A joint innovation strategy developed by the mining cluster

- Swedish mining companies
- Equipment- and system suppliers
- Institutes and universities

Vision

Sweden is a role model for social, economic and environmentally sustainable mining and metal production

→ National R&I programmes

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R&I roadmap areas
- Sustainability in focus

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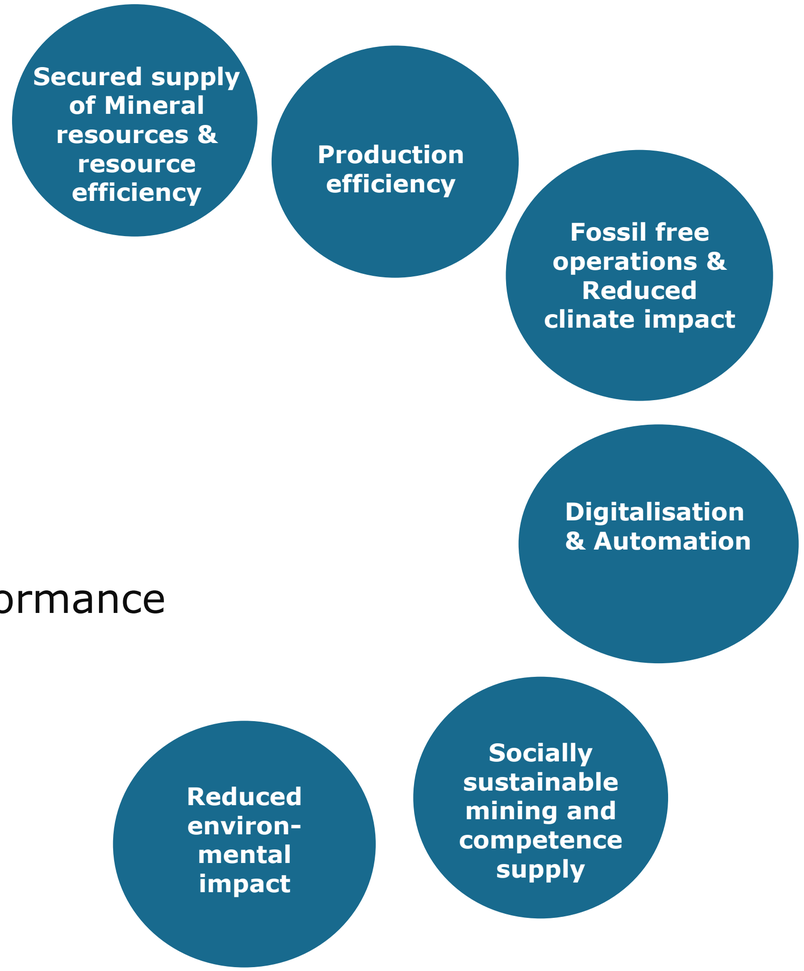
SUSTAINABILITY through the value chain

- Exploration & Prospecting
- Resource characterisation
- Mining
- Mineral processing
- Metallurgy & Recycling
- Reclamation & Environmental performance
- **Attractive Workplaces**
- **Gender and diversity**
- **Social acceptance**



The Swedish Mining Innovation programme

Industry driven programme, started 2013.

Open to all stakeholders who contribute to meeting its vision and goals.

Funding

50% public / 50% private

Steering board

Industry (LKAB, Boliden, Epiroc, Zinkgruvan, Ecogain, Swedish Mining Association, institutes and academia)

Innovation in collaboration – industry, academia, institutes, NGOs

- Innovation projects
- Strategic projects
- Education
- PhD network
- Symposiums, workshops & meetings
- Innovation idea competition
- Swedish Mining Innovation Award
- Internationalisation and Outreach

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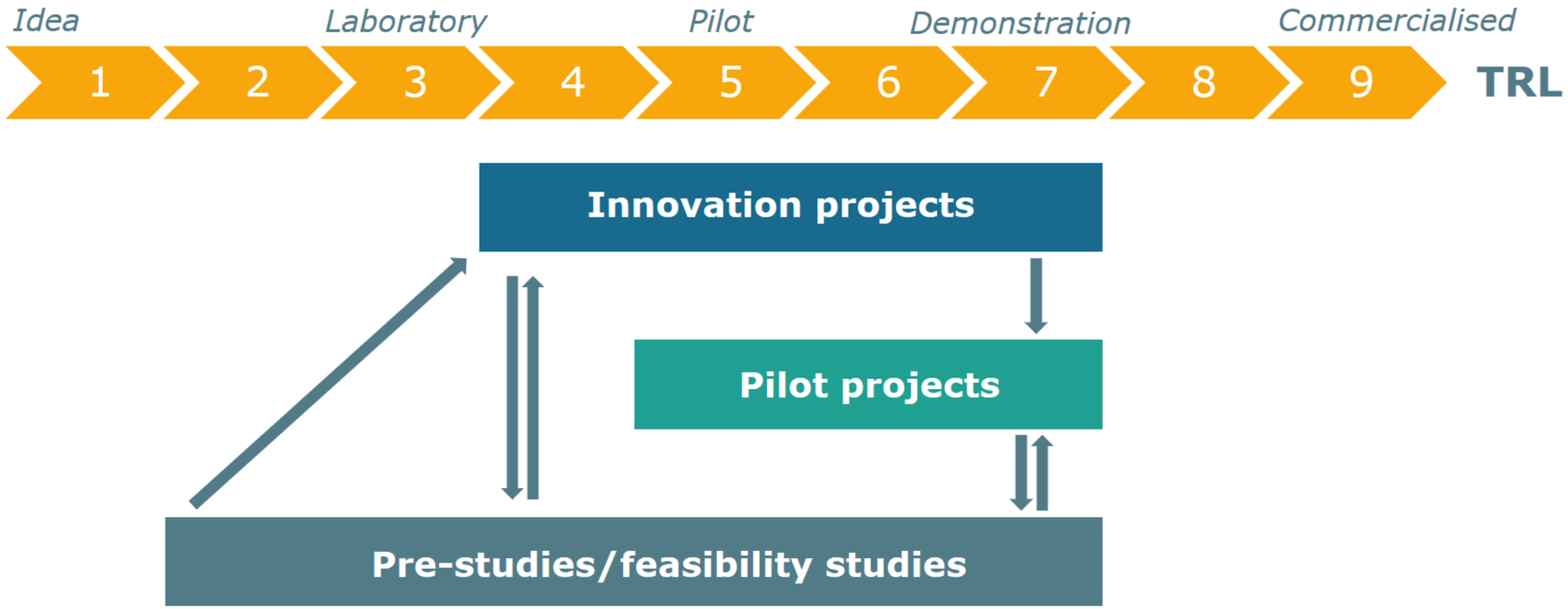
Research and Innovation projects



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Combined strength and strategic projects

Examples

- Roadmap för Long-term Competitiveness and a Fossil-free Mining and Minerals Industry (Svemin, RISE)
- The Swedish Mining Sector in Sustainable Futures (Svemin, SEI)
- Traceability of Sustainable Metals (Svemin, RISE)
- Diversity, gender equality and attractive workplaces in the Swedish mining industry (LTU)
- Mining with nature –roadmap for increased biological diversity (Svemin, Ecogain)

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SUM - Sustainable Underground Mining

LKAB, ABB, Epiroc, Combitech and Volvo Group initiated an in-depth cooperation, SUM, in the summer of 2018.

The goal is to set an entirely new world standard for sustainable mining at great depths.

The work is being divided into three phases:

- Construction of the test mine at LKAB and start of pilot trials, 2018-2022.
- Decisions on future main levels and construction on an industrial scale, 2022-2030.
- A new global standard for sustainable mining deeper in LKAB´s underground mines, 2030-2060.

https://sustainableundergroundmining.com/index-en/

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The New York Times | BUSINESS DAY

The Robots Are Coming, and Sweden Is Fine

In a world full of anxiety about the potential job-destroying rise of automation, Sweden is well placed to embrace technology while limiting human costs.

阅读简体中文版 | 閱讀繁體中文版 | Leer en español

By PETER S. GOODMAN DEC. 27, 2017

Boliden Electric trolley

Boliden is investing 30 MEURO in the expansion of electrified transport at the two open-pit mines of Aitik and Kevitsa, 2020-2021.

Estimated effects:

- Diesel consumption will be reduced by 5,500 cubic metres per year.
- Productivity gains as the electrically powered trucks can operate at a higher speed.
- The work environment for drivers will also be improved, in part thanks to lower noise and reduced need for maintenance.

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Present state fossil free mining

- The mining- and minerals sector generates 7-9% of the total carbon dioxide emissions in Sweden
- Fossil fuels are used in multiple parts of the industry’s value chain, greenhouse gas emissions arise from transport and mining operations and from the processing of iron ore, metal ores, limestone and cement
- Most of the emissions come from production of iron ore pellets, smelting of ore into metals, and limestone and cement production
- Many processes and technologies in use are already fossil-free, particularly in mining operations, which are already extensively electrified
- Digitalisation continues to drive efficiency, reducing the sector’s overall energy and fuel requirements, and initiatives to further reduce the use of fossil fuels in mining are underway
- Fossil fuels and related emissions still arise in transportation, in parts of the mining process, & in the thermochemical processing of ores and minerals

Mining operations –fossil free 2035

Machines and transportation within mining operations can be fossil-free by 2035, supported by biofuels where electricity can’t be used.

Further automation and digitalisation will reduce energy needs and result in more efficient and optimized operations.

Infrastructure for charging, possibly alongside hydrogen tanking, will complement a strengthened electricity distribution network

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HYBRIT –fossil free ore-based steelmaking

SSAB (global leader in high-strength steels), LKAB (Europe's largest iron ore producer) and Vattenfall (a leading European energy company)

The HYBRIT mining-iron-steel-energy value-chain aims to develop the world's first fossil-free ore-based steelmaking technology.

- replacing coal with fossil-free electricity and hydrogen
- eliminate CO2 emissions
- mitigate climate change.

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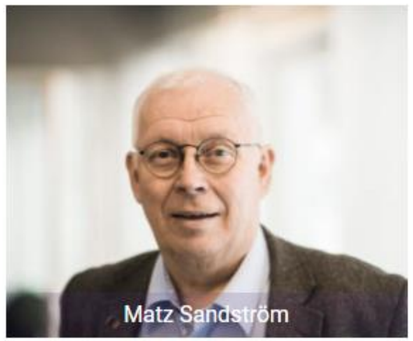

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Mining innovation for a sustainable future

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