



Boliden Garpenberg – High productivity and cost efficiency

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BOLIDEN

High productivity and cost efficiency

Strong technology know-how

Integrated control system
Mobility and Wlan
Advanced maintenance system
Autogenous grinding

High degree of automation

Fully automatic process from crushing to filtering of final product
AutoMine system

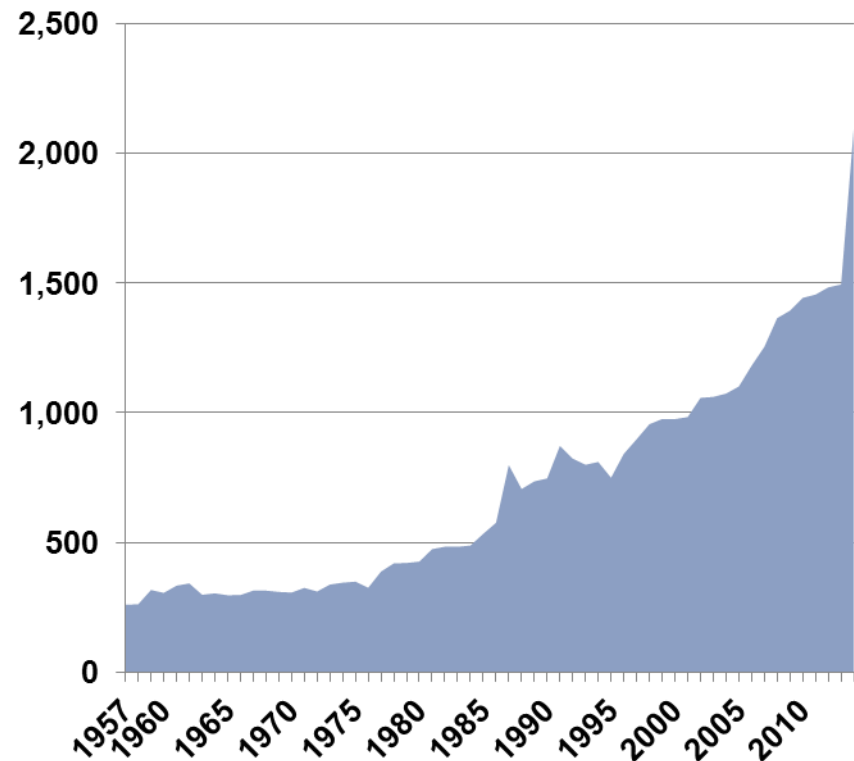
Optimising asset through mine design

Detailed long-term planning

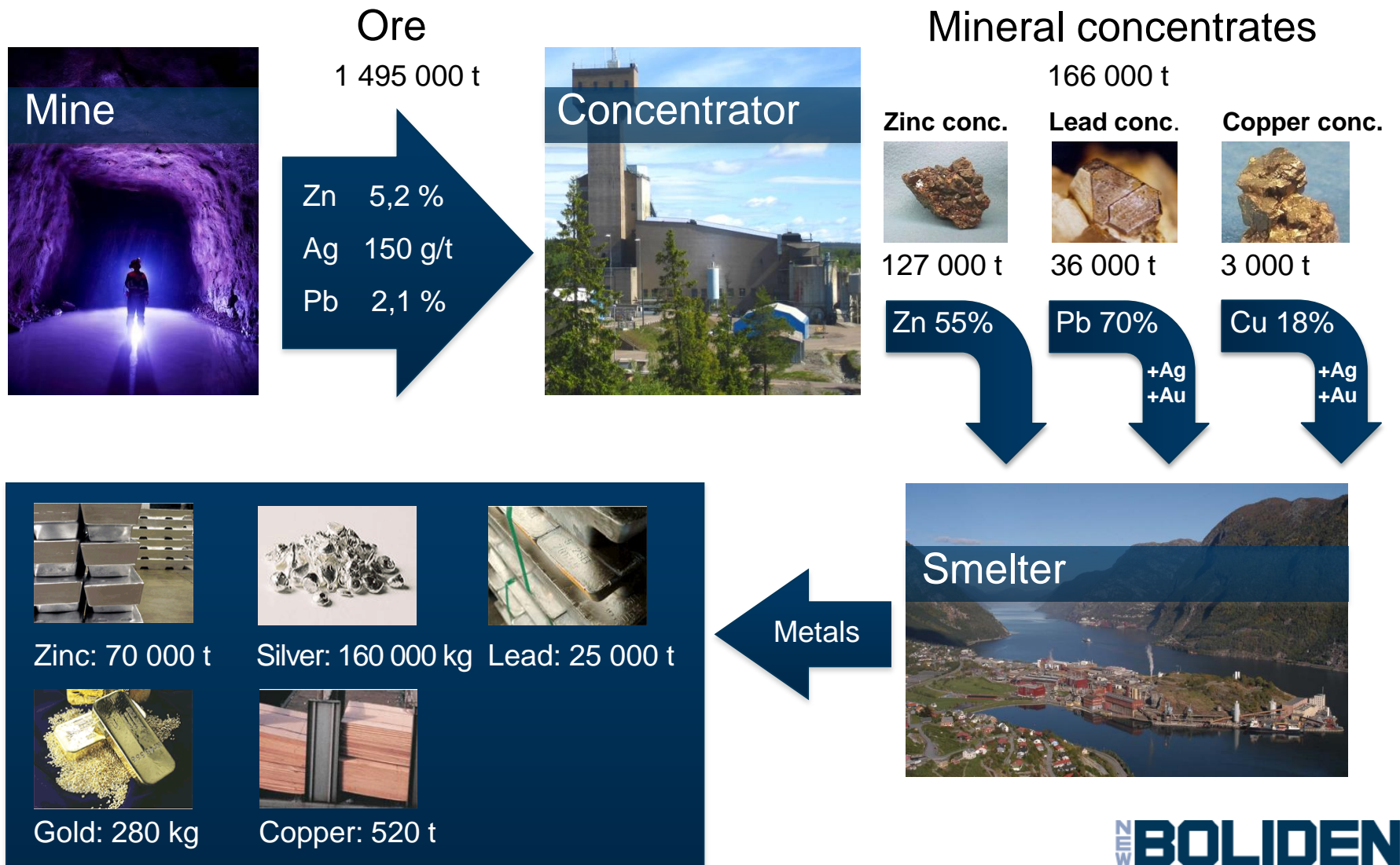
Garpenberg – One of the world's oldest and most modern mine

- Sweden's oldest mining area in operation
- Deposits first mined in the 1200s
- Acquired by Boliden in 1957

Milled ore, kton (1957-2014)



From ore to metals 2013

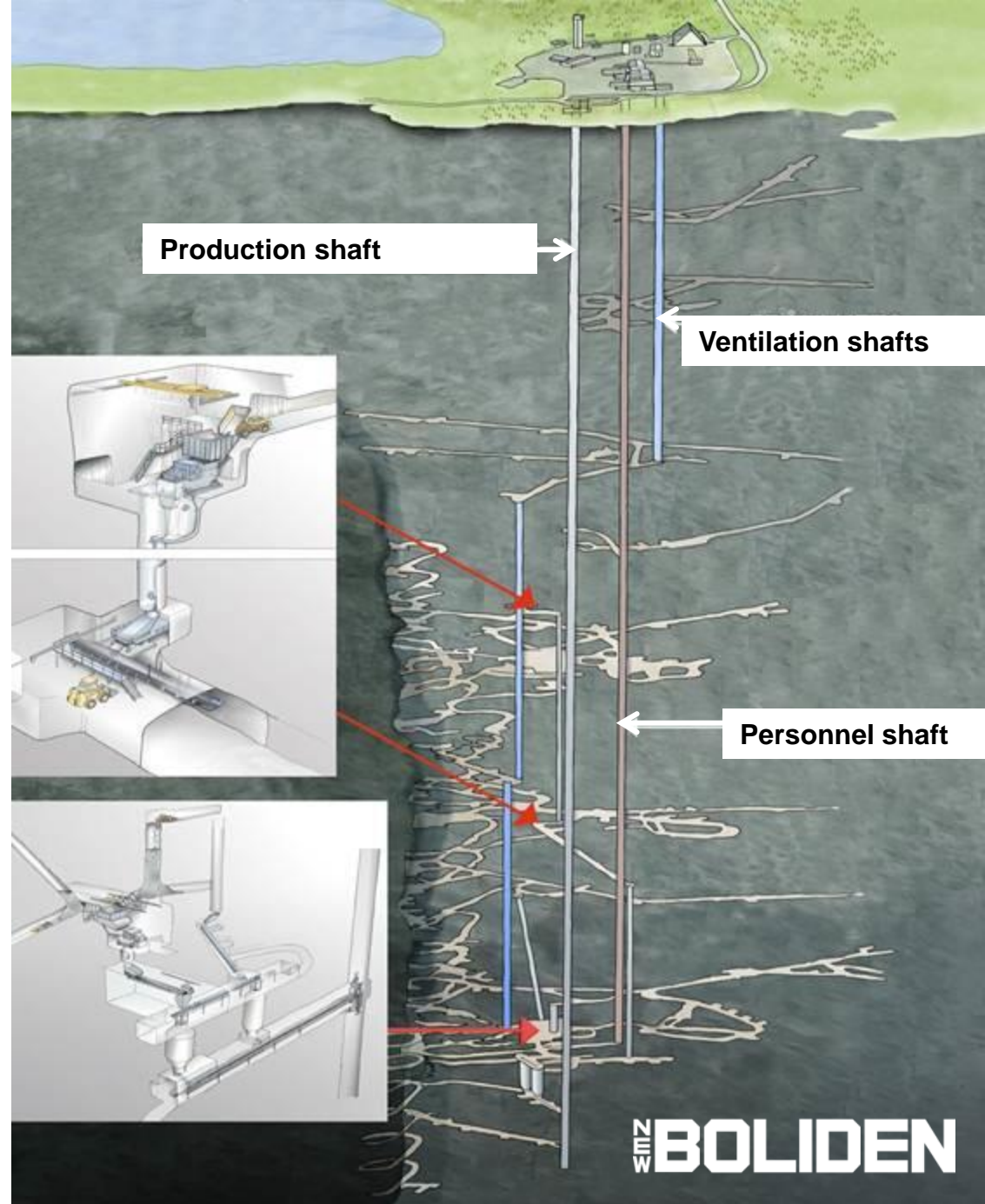


Garpenberg 2.5 expansion

- From 1.4 to 2.5 mt of ore/year
- Production start May
- New industrial area
 - New underground facilities
 - New concentrator
 - New infrastructure
- Capex SEK 3.9 billion
- Boliden's 2nd largest investment
- Reserves 36.3 (25.6) Mton
- Resources 38.1 (44.5) Mton



Underground facilities





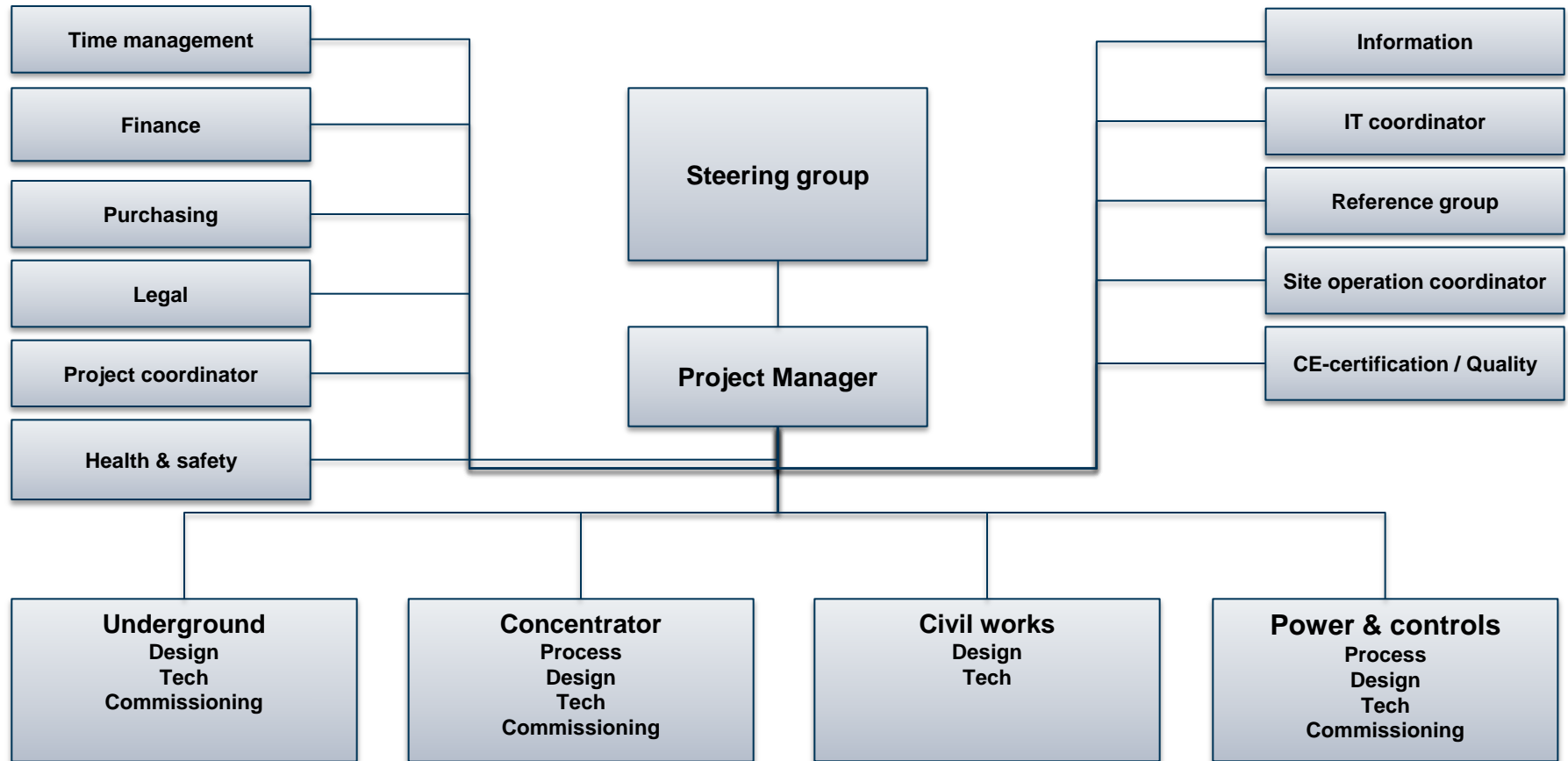
New industrial area

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Inauguration of Garpenberg – 26 August 2014

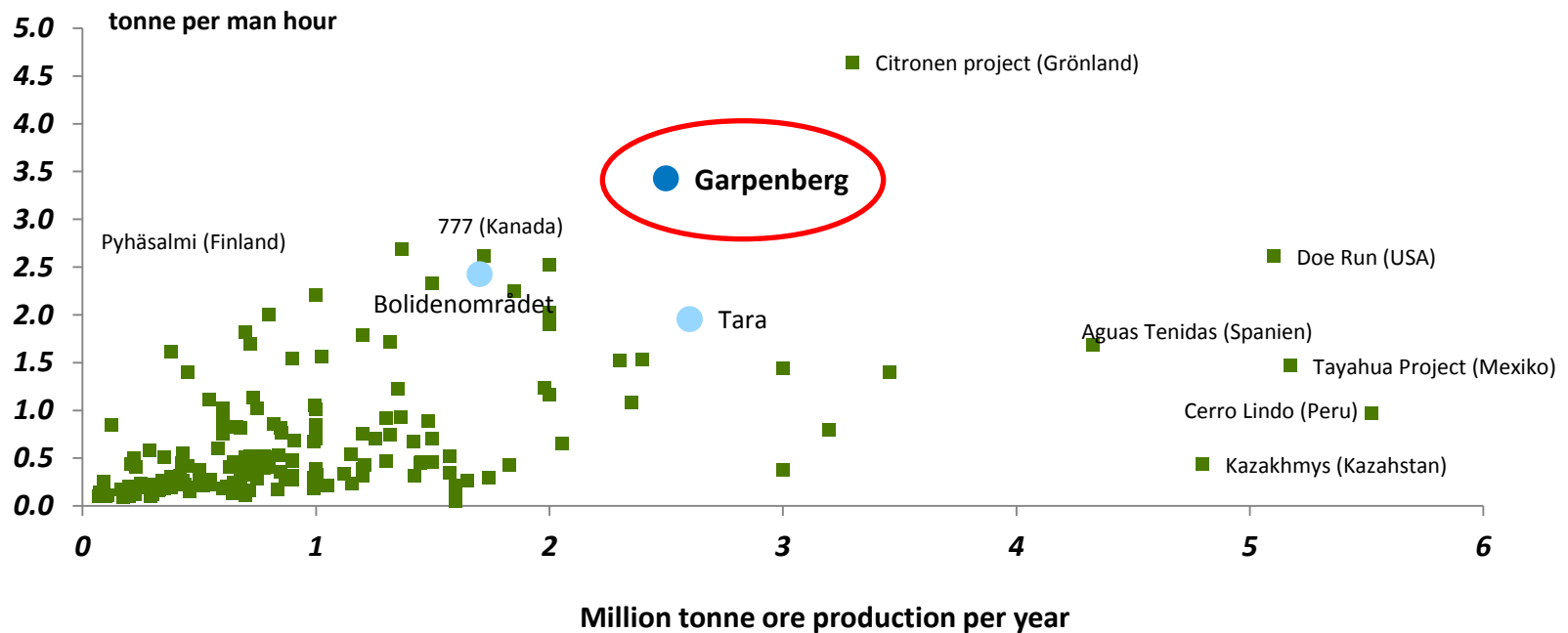


In-house project management key factor to deliver on time and budget



High level of productivity

Zinc - underground mines 2016



Source: Wood Mackenzie

Integrated control system drives efficiency

- One of the first mine with an integrated control system for mine and mill
 - General overview
 - Sequence start and stop
 - Mobile control room
 - 130 HD cameras
- Improved control
 - Analysing production disturbances with alarm lists and event log
 - On-stream analysis system, 24 different samples
- Lower costs for maintenance
 - Integrated with maintenance system



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Mobile control room increases flexibility



Advanced maintenance system for high availability

- Monitors critical machines to minimise breakdowns
 - Online vibration measurements
- Integrated with control system
 - Improved surveillance
 - Easier access to maintenance system
 - Easier to make a work order
 - Easier to get access to drawings and other documents
 - Easier to make notice of error
 - Diary improves visibility over time



NEW BOLIDEN

WLAN enables high degree of automation and access of information

- Implemented in vital parts of mine
- Condition for autonomous loaders
- Plans for status control and operational guidance



Autogenous grinding – lower costs

- Ore grinds itself
- Lower costs
 - No external grinding media added
 - Less mill liner wear
- Grinding technology in all Boliden mines



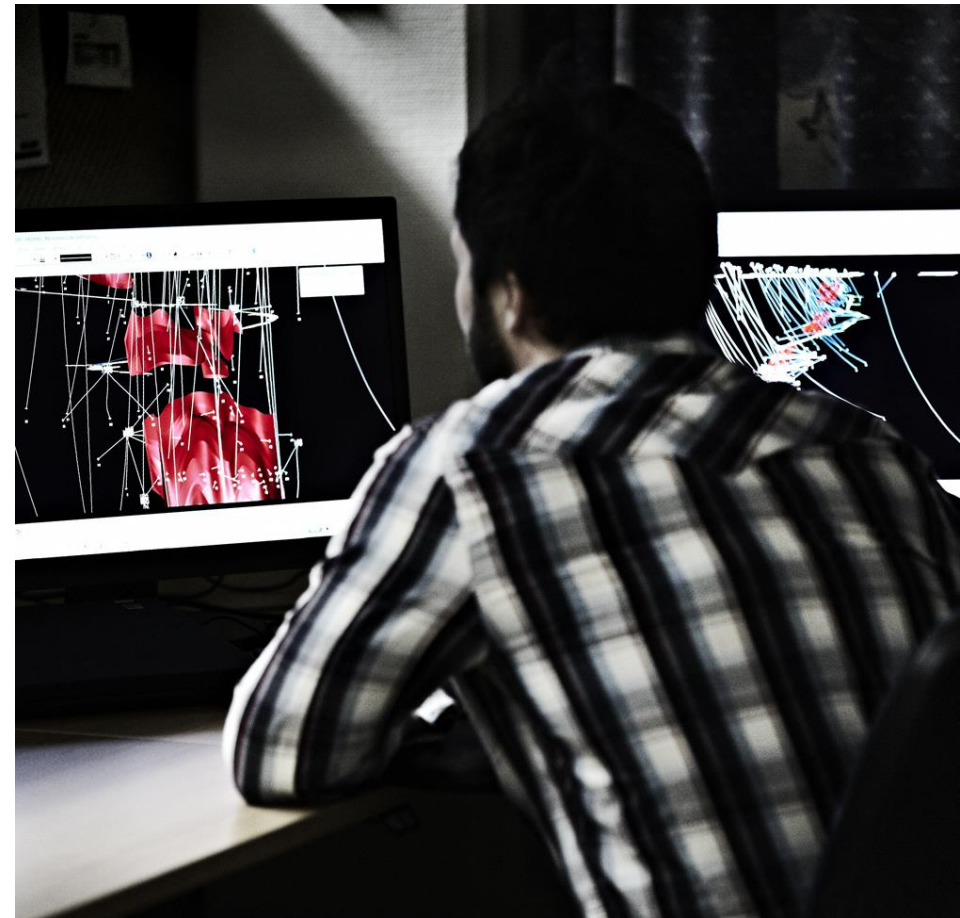
Higher productivity through autonomous loaders – AutoMine system

- Loading and hauling the ore after blasting
- Controlled remotely via WLAN
 - Operator can be in a control room
 - Loading and unloading by remote control by operator
 - Transporting between loading and unloading autonomous
- Ability to operate during blasting
- Improved safety



Mine design

- Designing for life of mine
 - Capex planning
 - Production planning
- Optimizing the NPV of the ore body
- Minimize lead time between work processes at faces/stopes/benches
- Mining is a huge construction project







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A person with dark hair, wearing a plaid shirt, is seen from behind, looking at two computer monitors. The monitor on the left displays a complex network graph with red nodes and white lines. The monitor on the right displays a similar network graph with blue and red nodes. The background is dark and out of focus.

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