

# FIE

## Föreningen för industriell elteknik, 2022 April Stockholm

(Presentation general in English presentation, Swedish talk. Some swedish slides is added )

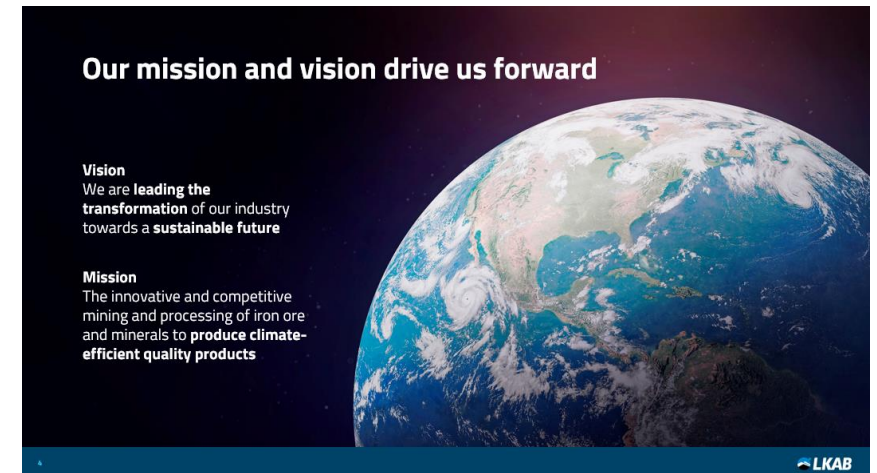
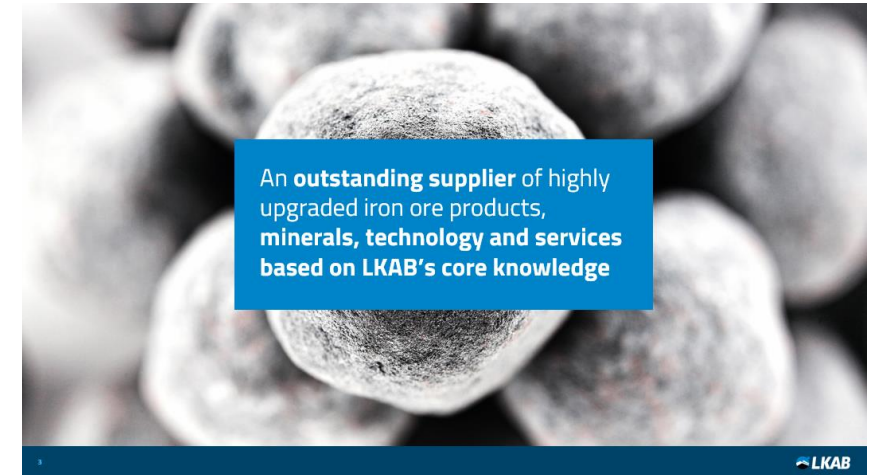
---

Per Tomas Uusitalo

Head of Development Automation and Power

# The world is changing and LKAB is part of the change

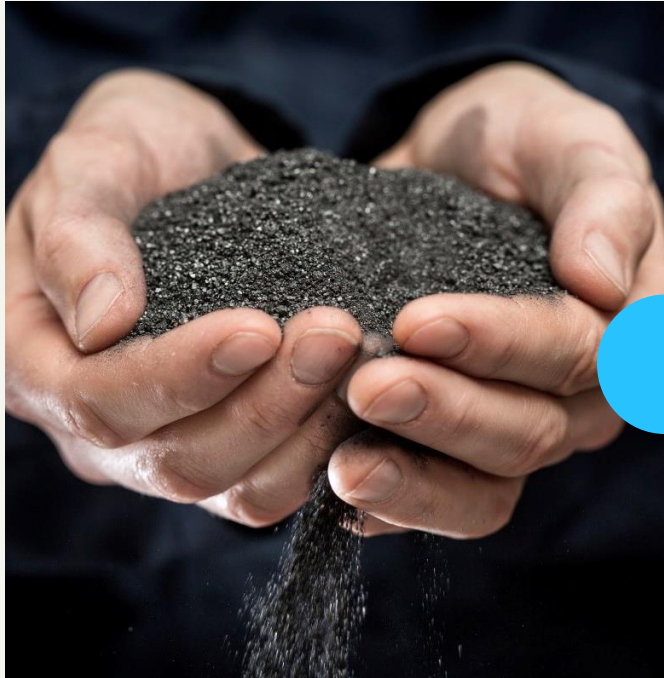
- Leading the transformation towards sustainable iron making based on LKAB's core knowledge
  - Minerals
  - Iron ore products
  - Technology and services
  - Climate-efficient quality products



# We take a new position on the market

A successive change from supplier to **iron ore pellets** to supplier of **sponge iron**

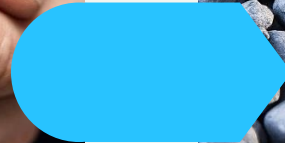
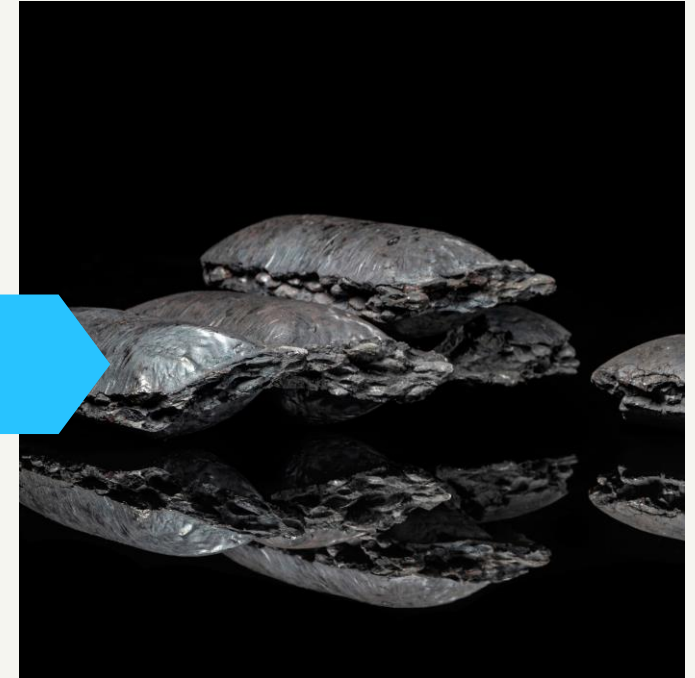
Fines



Iron ore pellets



Sponge iron



# The future of LKAB

Change in **three major areas**

New world standard  
for **mining**

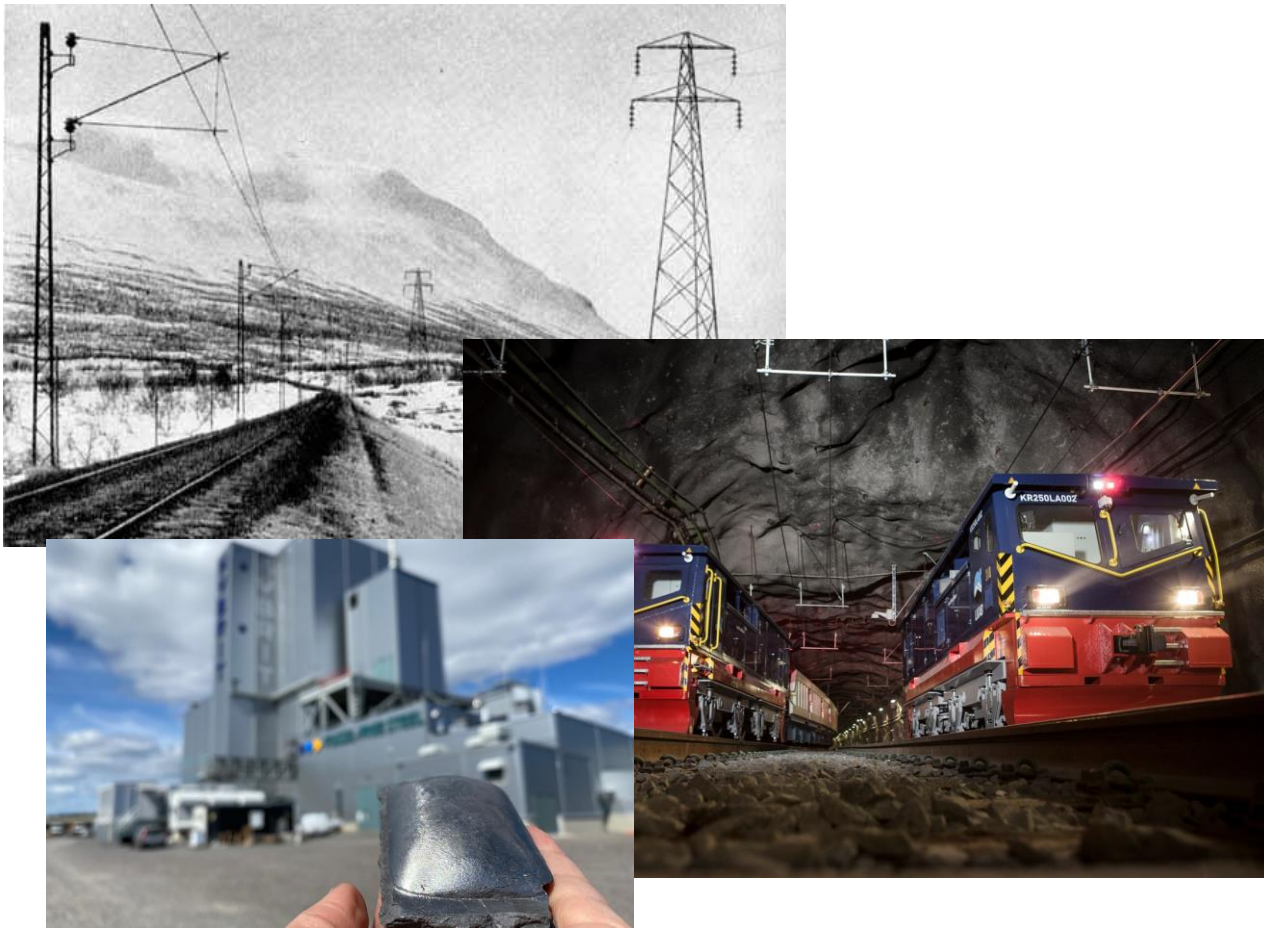
**Carbon-free sponge  
iron** with hydrogen  
technology

**Extract critical  
minerals** from mine  
waste

SUM project presentation

**3 min film, not included  
due to it's size.**

# Historical LKAB milestones in Electrification & Automation



- **1915-1923 Elektrifiering av Malmbanan mellan Luleå och Narvik**
- **1957 Automatisk uppföring**
- 1960 Fjärrstyrning av spårväxlar
- 1960 Fjärrstyrning av blocksträckor
- **1973 Automatiska tåg**
- **1979 Fjärrstyrd tappning**
- **1979 Första helt datorstyrda kulsinterverk**
- 1992 Modellbaserad kvarnstyrning i anrikningsverk
- 1996 Överordnat system för realtidsinformation införs, IP21
- **1996 Fjärrstyrd produktionsborrning**
- 1999 Helautomatisk lastning
- 1999 Fjärrstyrd skutknackning
- 2001- Nya generationer av automatiserade gruvmaskiner
- 2002-2015 Införande av gemensam systemplattform 800 xA i SAK
- 2009- Online uppkoppling och fordonsdatorer för all produktionslastning
- **2010-2017 Heltäckande trådlöst nätverk införs i gruvorna, 3000 accesspunkter**
- 2015- Heltäckande realtidspositionering av människor och maskiner (IoT)
- 2016- Realtidsplanering/uppföljning och styrning av tillredning med fordonsdatorer
- 2018- Heltäckande trådlöst nätverk produktionsanläggningar ovan jord
- **2018- Utveckling av den digitaliserade, hållbara och autonoma i Konsuln gruvan.**

# LKAB's development areas

Our focus in the transformation process

**Mining**

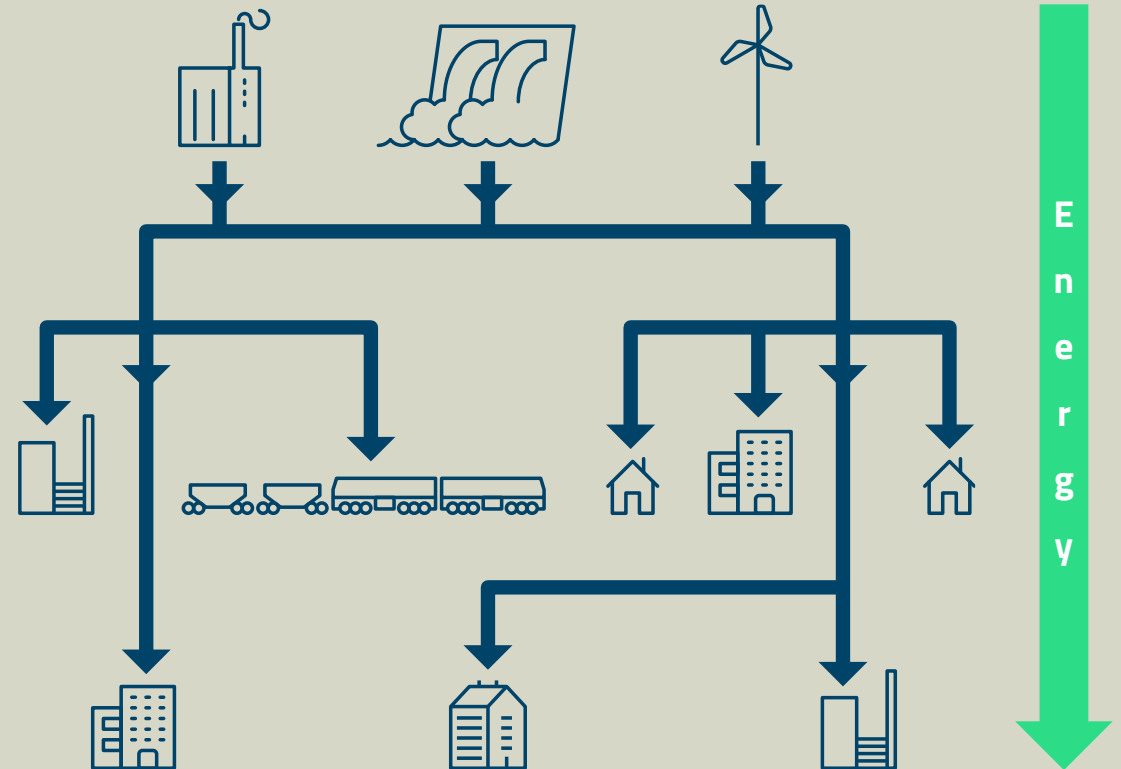
**Processing**

**Digitalisation**

**Electrification & Hydrogen**

# Our strategic approach – current position (2019)

- **2,2 TWh electricity** and **2 TWh fossil energy** consumption
- **Re-investments** needed
- Implementation and measurement of risk elimination, interference, **immunity and energy efficiency**
- Still some **manual management and analogue processing**





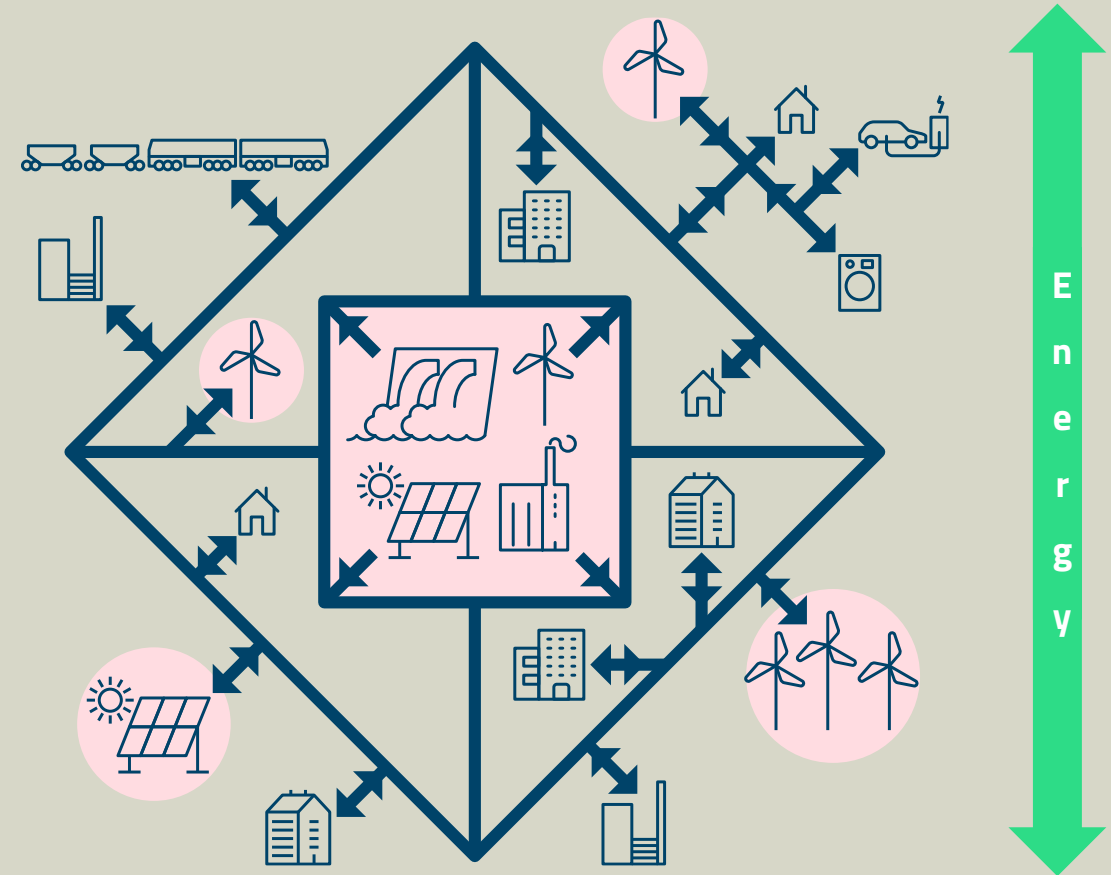
# Our strategic approach – towards the vision

## Goals for 2030

- Electricity consumption, **20 TWh**  
(Electricity production Sweden 2020, 159 TWh)
- **Capacity to produce** electricity from excess energy (heat and/or hydrogen)
- Facilities **adapted for business** need
- Power quality, facilities and **working methods** are up to date
- Working tools and processes are **digitalized and automated**

## Goals for 2050

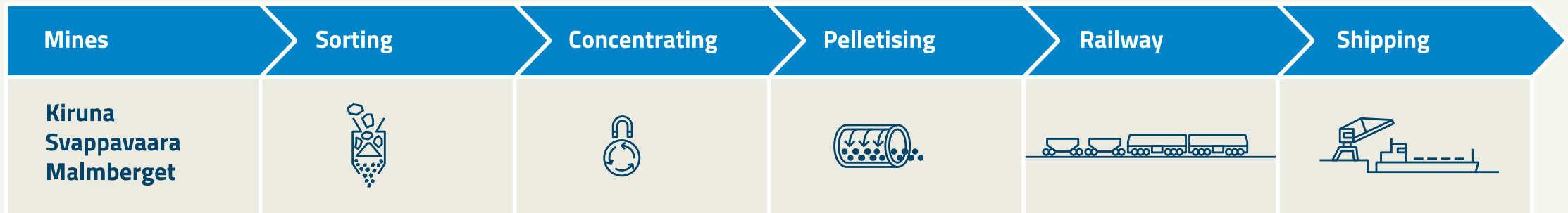
- Electricity consumption, **55 TWh**



# Overall Equipment Effectiveness

Apply and develop electrical installations with high OEE

OEE – an essential tool for analysis and increased productivity through the whole value chain



## Availability

- Active redundancy
- Mobile switchgear
- Interference immunity

## Performance

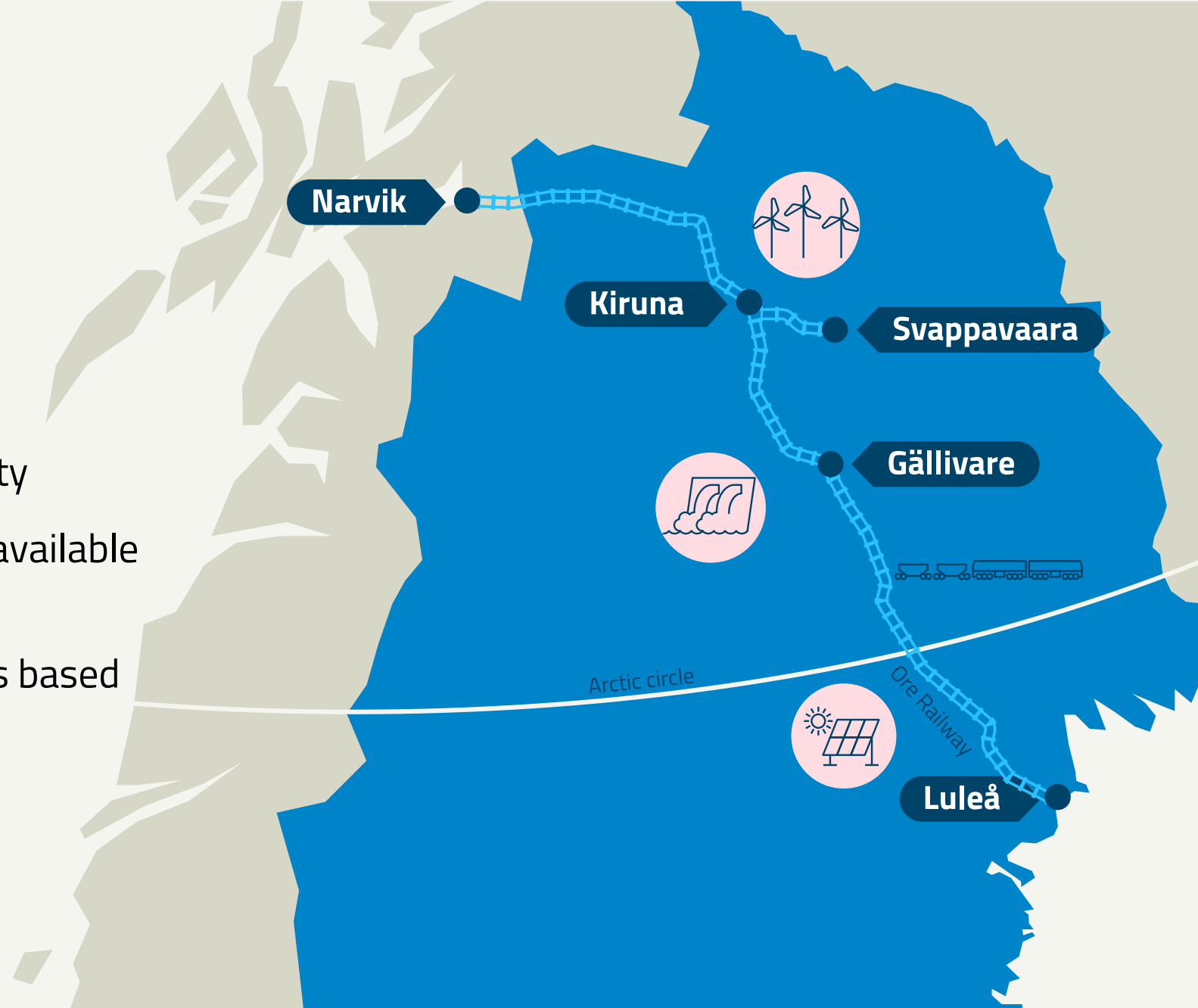
- Digital models in early stages
- Optimal dimensioning
- Cost efficiency
- Measuring of energy and power

## Quality

- Voltage dips
- Frequency stability
- Harmonics
- Optimal relay protection settings

# Why Electricity?

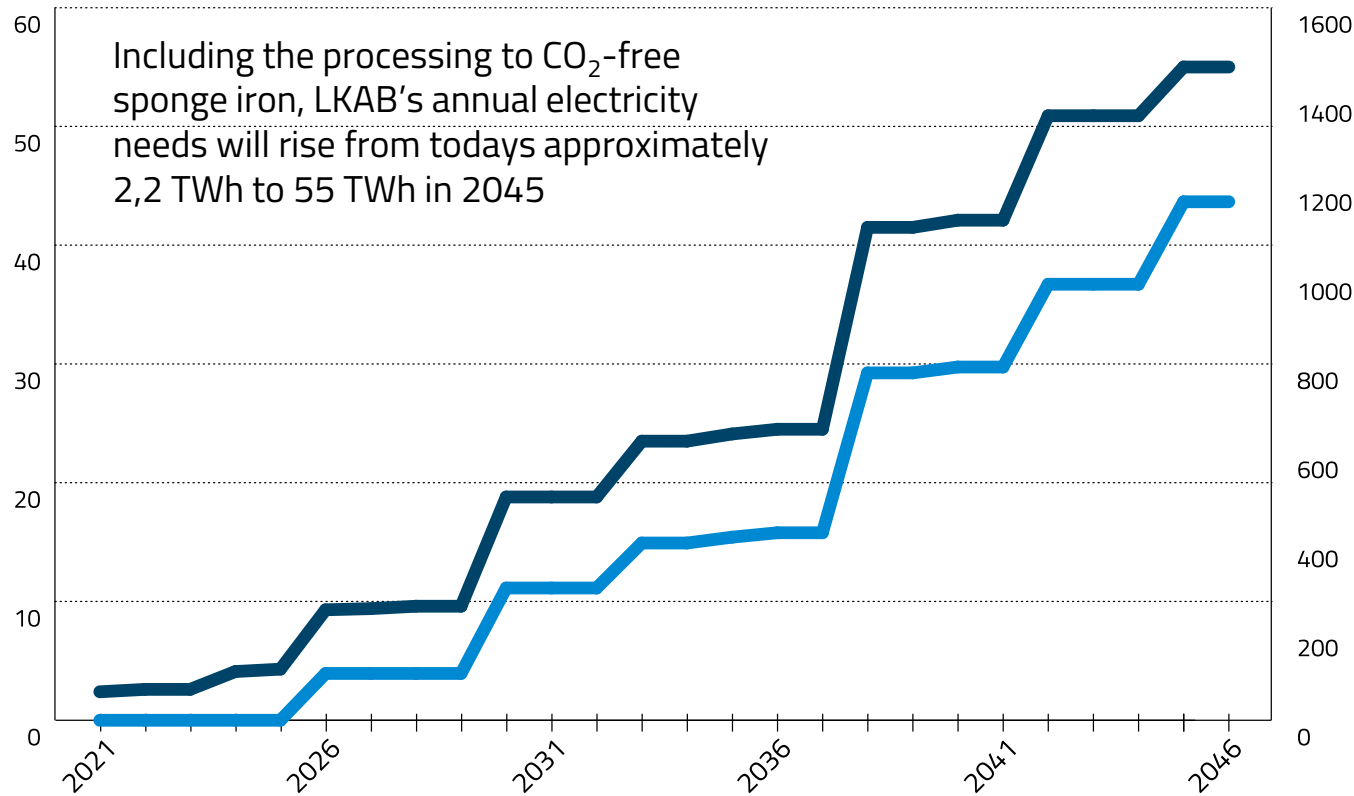
- Renewable (water, wind, sun)
- Zero CO<sub>2</sub>
- High efficiency, accessibility, quality
- High tech solutions and products available or under development
- Major part of LKAB infrastructure is based on electricity
- Good access (in northern Sweden)



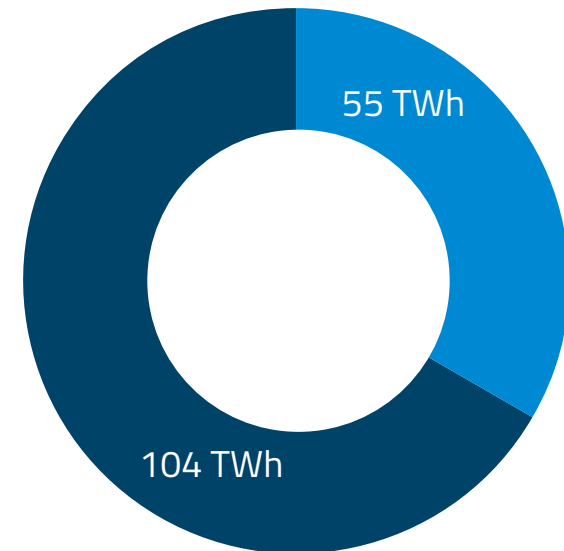
# Electricity needs and hydrogen production

Electrical power TWh

Hydrogen kTon



LKAB's future needs equals more than a third of Sweden's total electricity production in 2020 (159 TWh)



Need of ELECTRIC POWER

**Not included, will be  
available in presentation.**

# Konsuln testbed – Sustainable underground mining

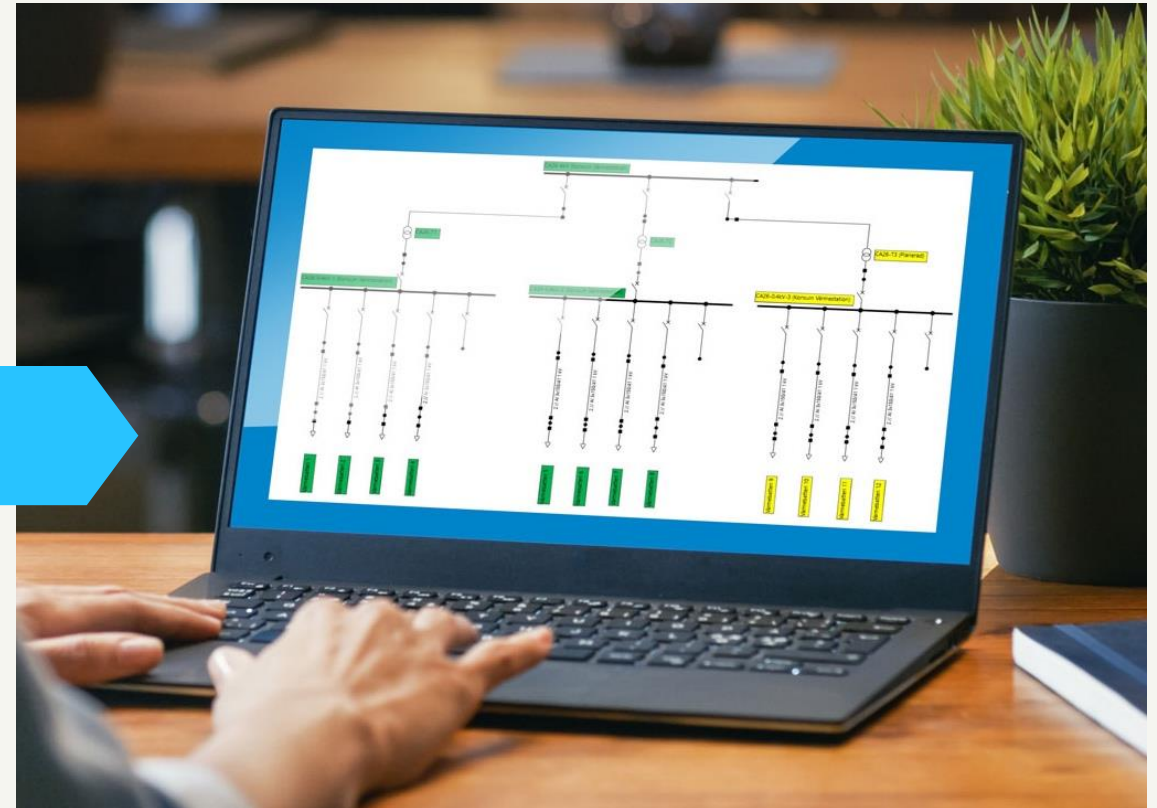
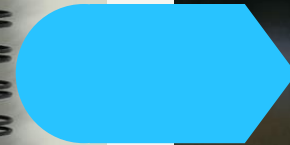
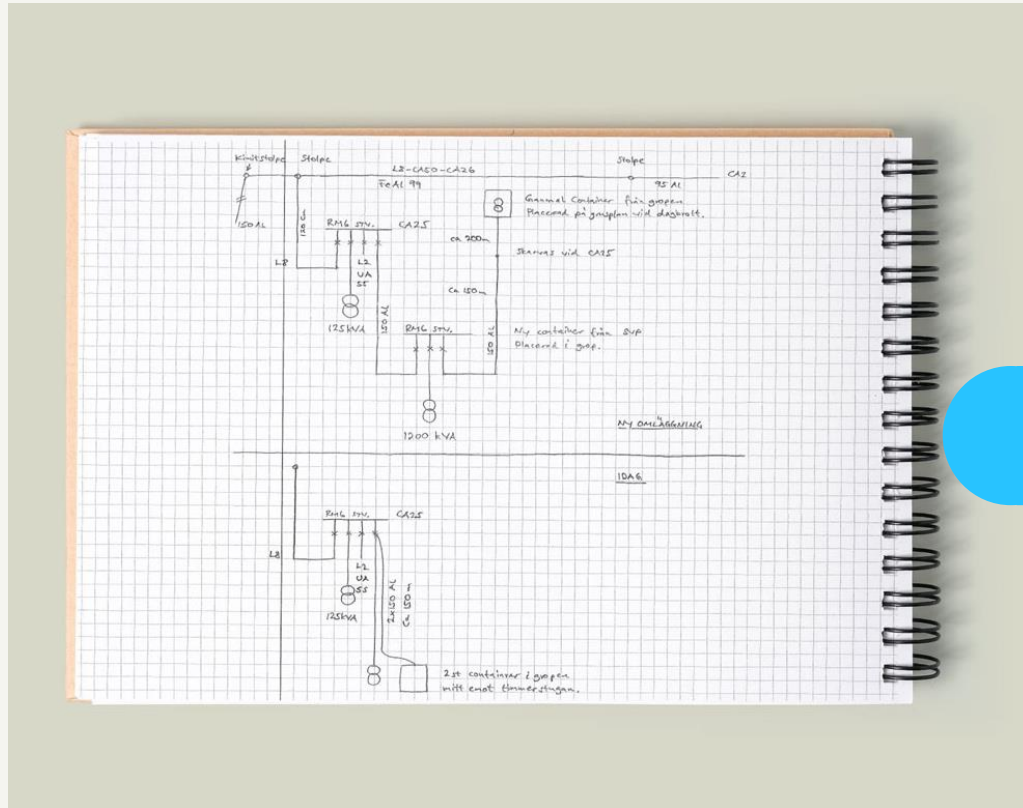
in one of Sweden's largest underground mines

## Testing in real mining environment

- New mining technology
- Digital modelling
- Model-based approach
- Location awareness
- Real-time information sharing
- 3D-visualisation
- Smart ventilation

# Digital model of the power grid

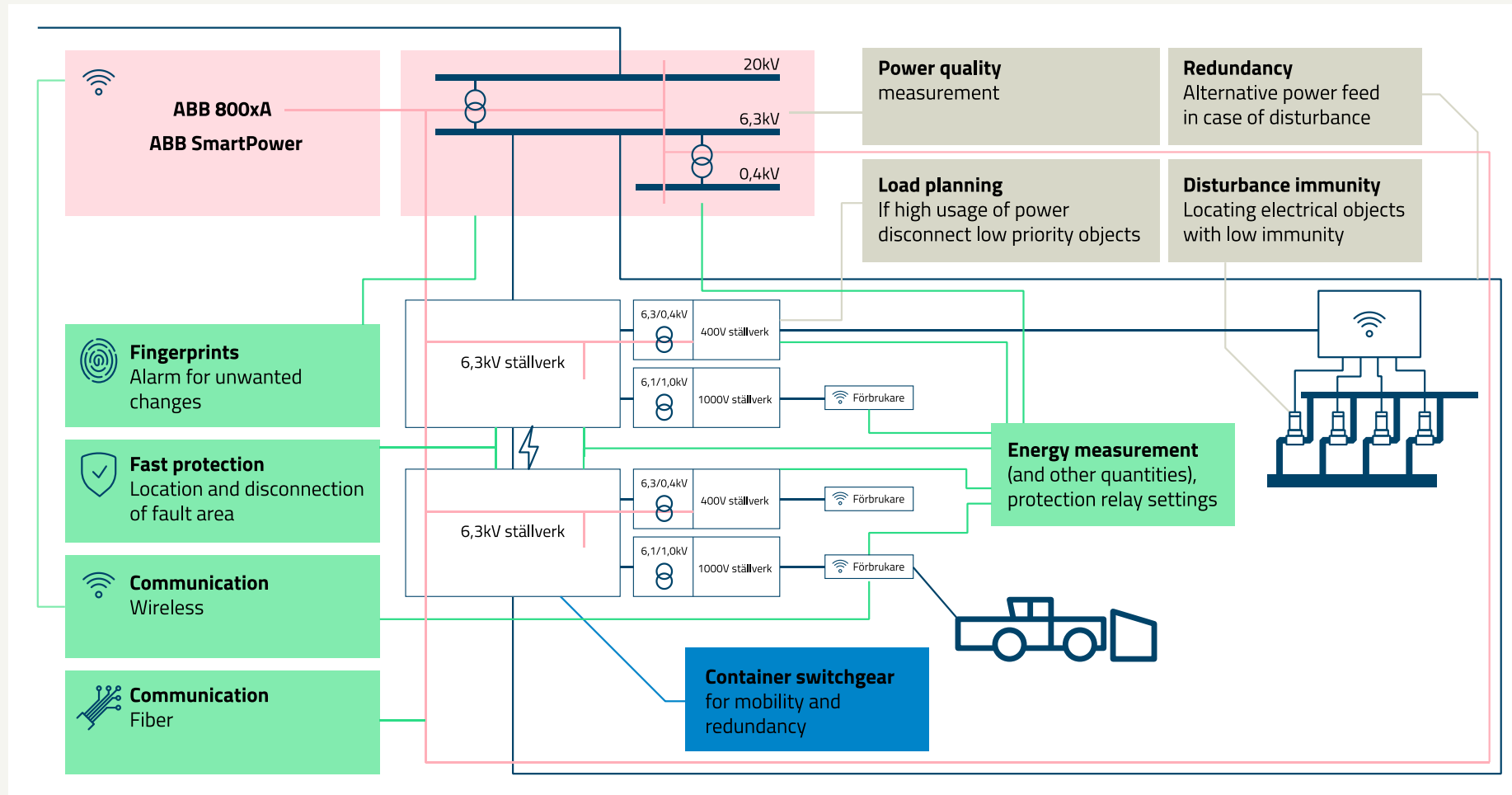
Digital models improves simulation, analysis, optimization and planning



From this...(Analog) ...to this (Digital)

# Model-based approach

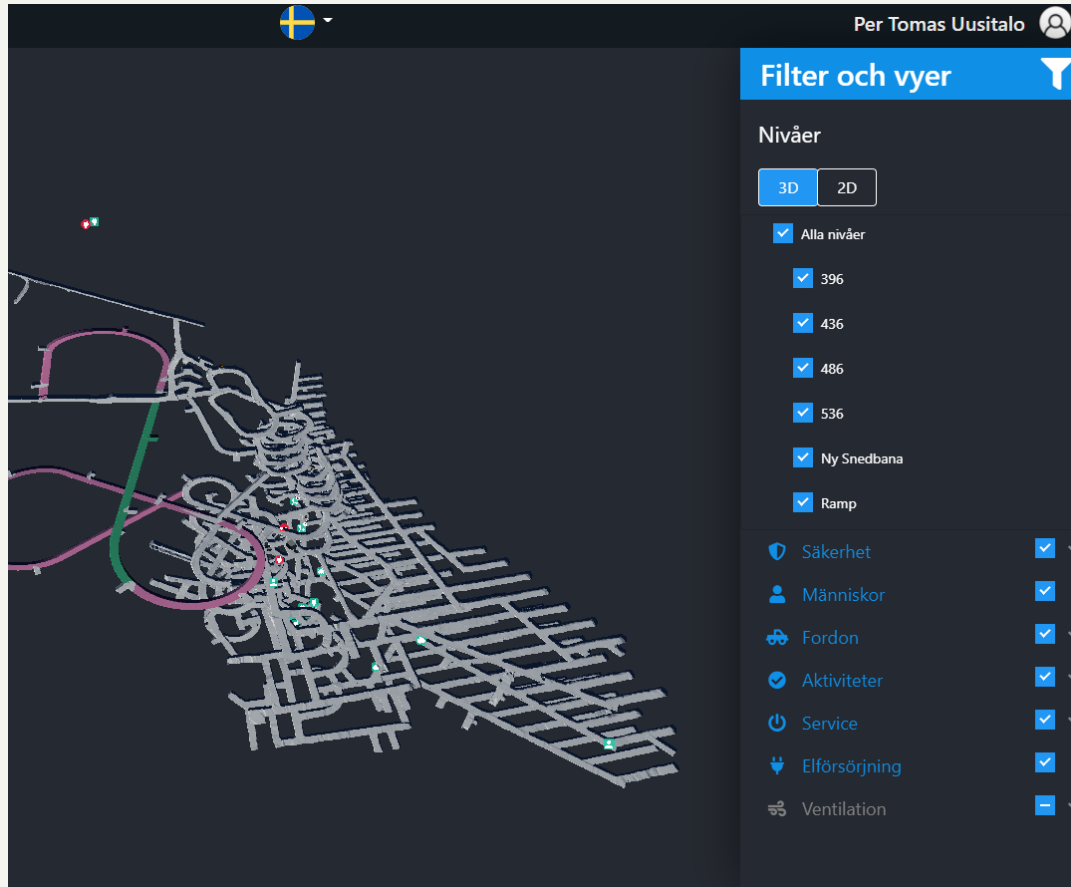
A holistic perspective for development through model-based approach





# Location awareness

Exact location of infrastructure, vehicles, people, documentation



<https://smite.dev.lkab.com/>

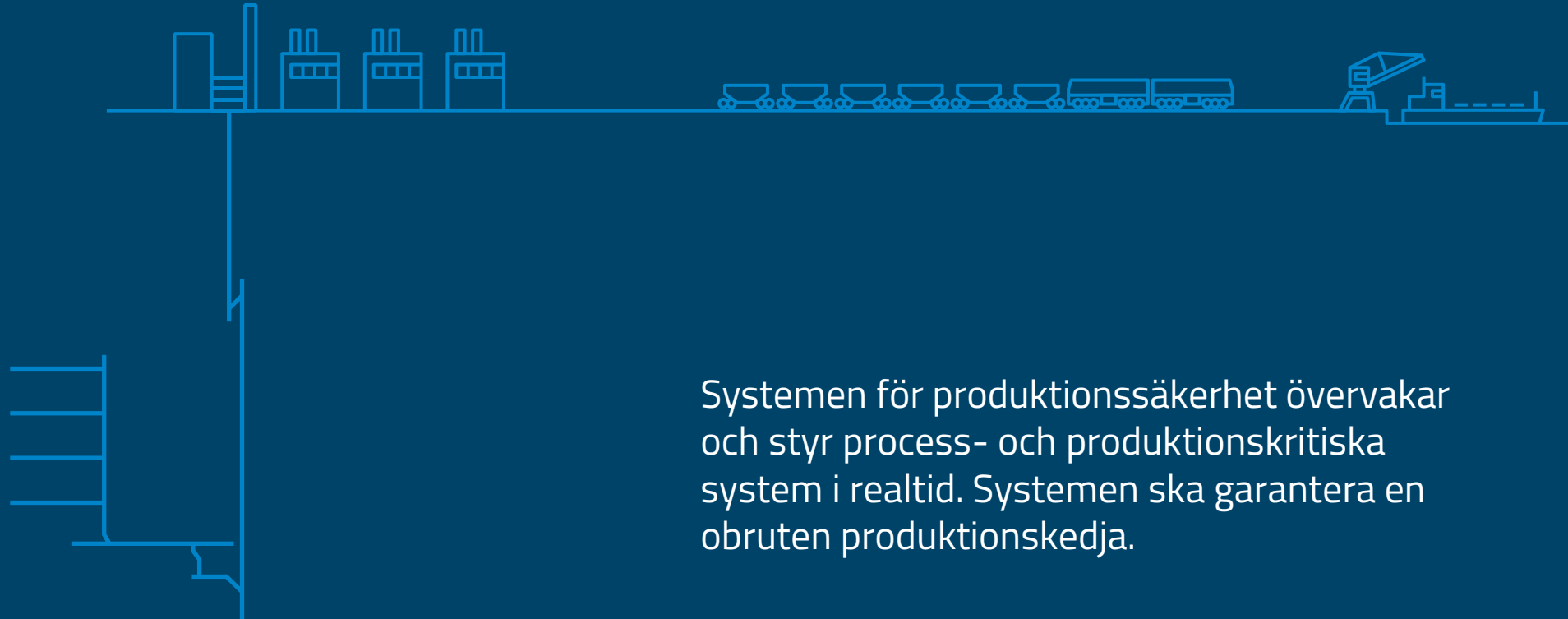
# Real-time information sharing

Improved information quality and real-time sharing everywhere



# Systemuppbyggnad och prioritetsordning

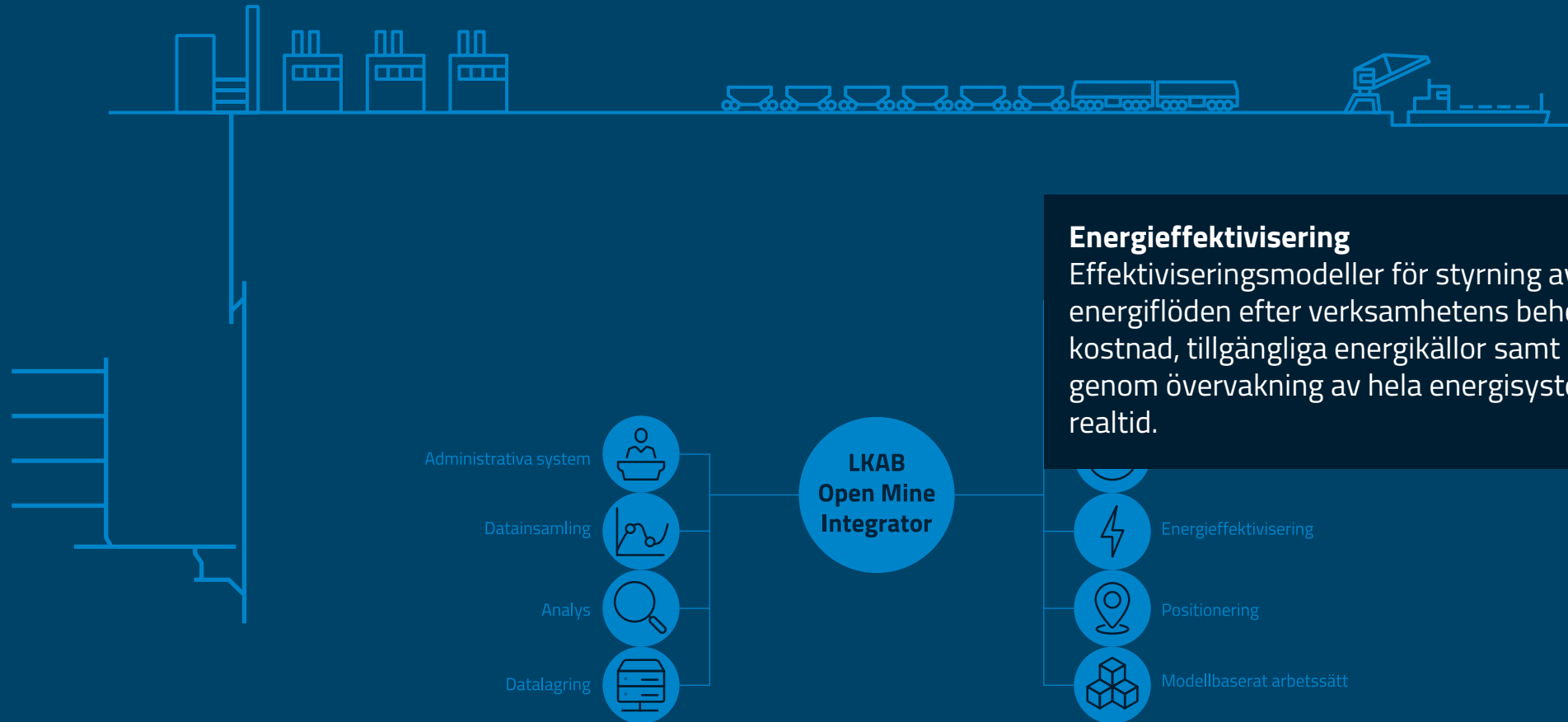
## Produktionssäkerhet



Systemen för produktionssäkerhet övervakar och styr process- och produktionskritiska system i realtid. Systemen ska garantera en obruten produktionskedja.

# Applikationssystem

## Energieffektivisering



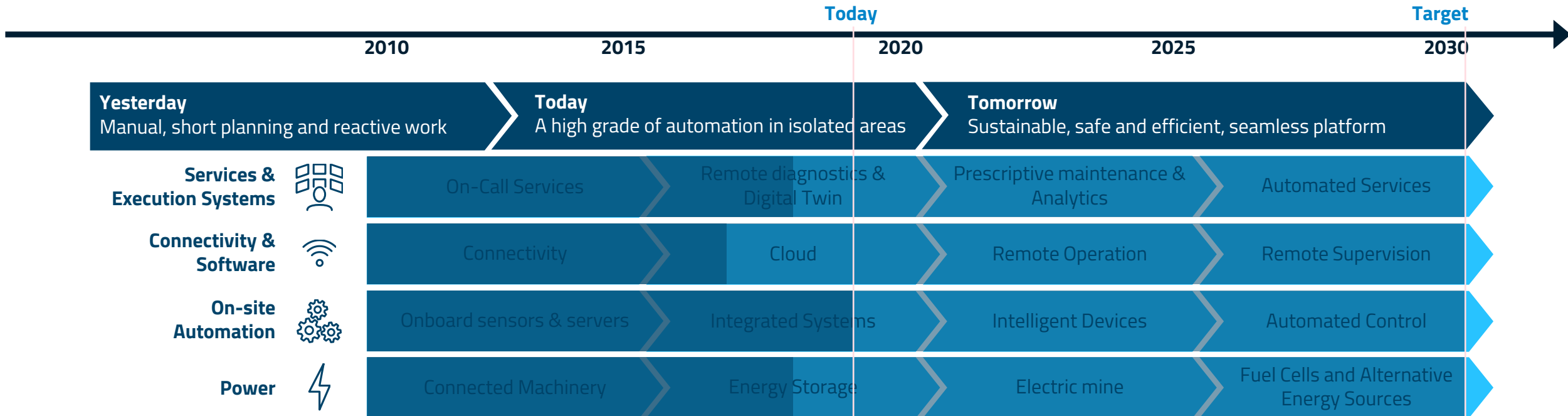
### Energieffektivisering

Effektiviseringsmodeller för styrning av energiflöden efter verksamhetens behov, kostnad, tillgängliga energikällor samt elkvalitet genom övervakning av hela energisystemet i realtid.

Elektrolysörer – Tidigt skeende i projektet

**Not included, will be  
available in presentation.**

# Power – part of digital transformation landscape



Thank you!  
Any questions?

