

Towards a fossil-free future

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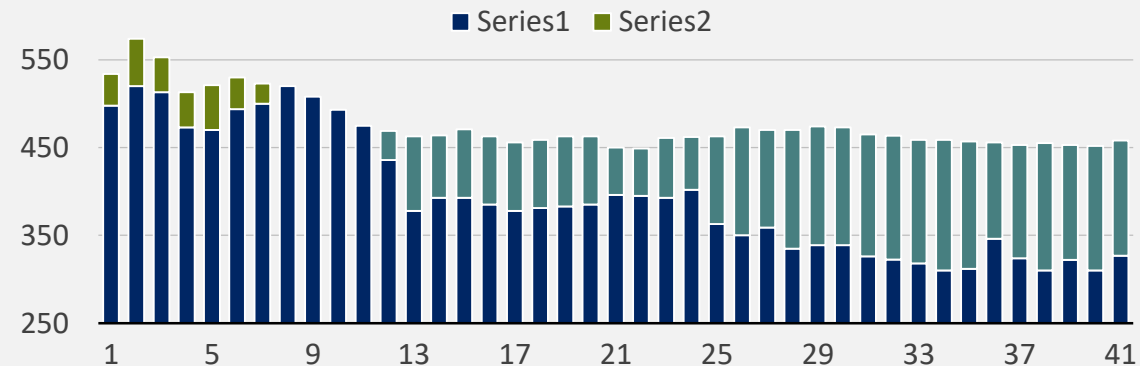
World leading technology development in Sweden and Finland

- ▶ Continuous progress of the blast furnace (BF) process for almost 200 years
- ▶ Step change in 1980's
 - LKAB development of iron ore pellets
 - SSAB development of BF-process:
 - Shut down sinter plants in Luleå, Oxelösund & Raahé

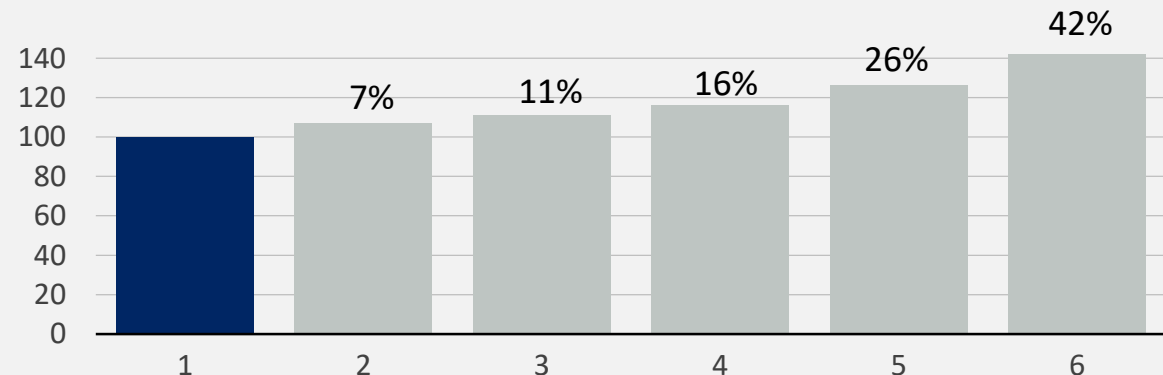
100% pellets operation in all 5 BF's – unique solution

Source: SSAB and Stahl-Zentrum. The indexed carbon efficiency in iron-making based on coal consumed 2012

Fuel rate – SSAB blast furnace in Luleå



Benchmark in terms of CO₂ emissions



Limited options to further develop blast furnaces

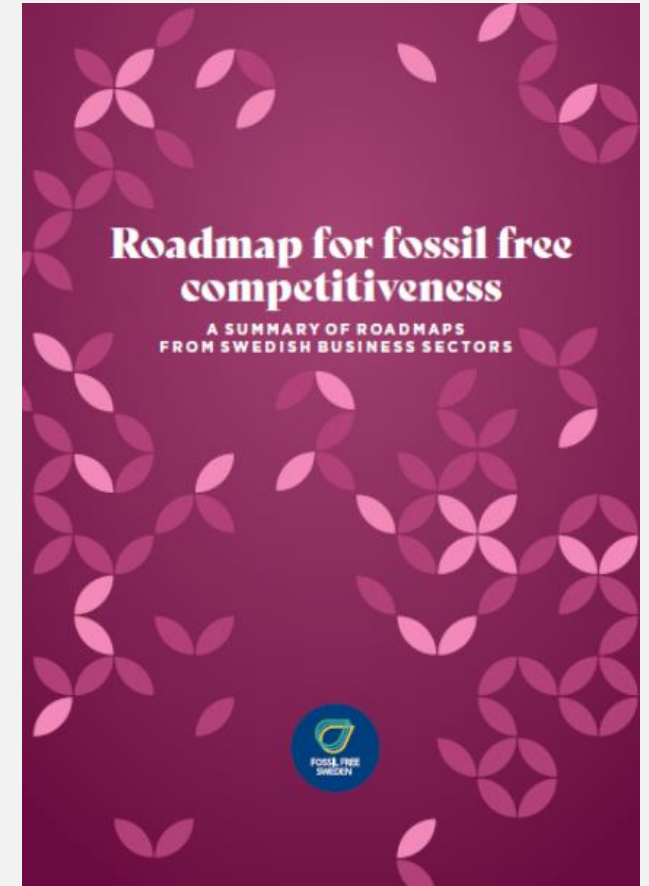
- ▶ Reduction of total fossil CO₂-emission by alternatives to Pulverized Coal Injection (PCI):
 - Biocoal, recycled plastic material etc.
 - Top gas recycling
 - Gas injection (Coke Oven Gas, H₂)
 - Plasma heating of blast (Electricity)
 - Oxygen (Electricity)
- ▶ Carbon Capture Storage (CCS)/Carbon Capture Utilization (CCU)
 - ULCOS trials at LKAB Experimental Blast Furnace

The BF-process is built on coke



Clear political direction towards fossil free Sweden

- ▶ Paris agreement & SDGs
- ▶ Political ambition to make Sweden one of the first fossil free welfare countries in the world
- ▶ Parliament cross-party agreement on net zero emissions by 2045 and a renewable energy system by 2040
- ▶ Fossil Free Sweden Initiative - *Roadmaps for fossil free competitiveness*
 - The mining and minerals industry
 - The steel industry
 - Several roadmaps (+10) from various sectors and more to follow during 2020





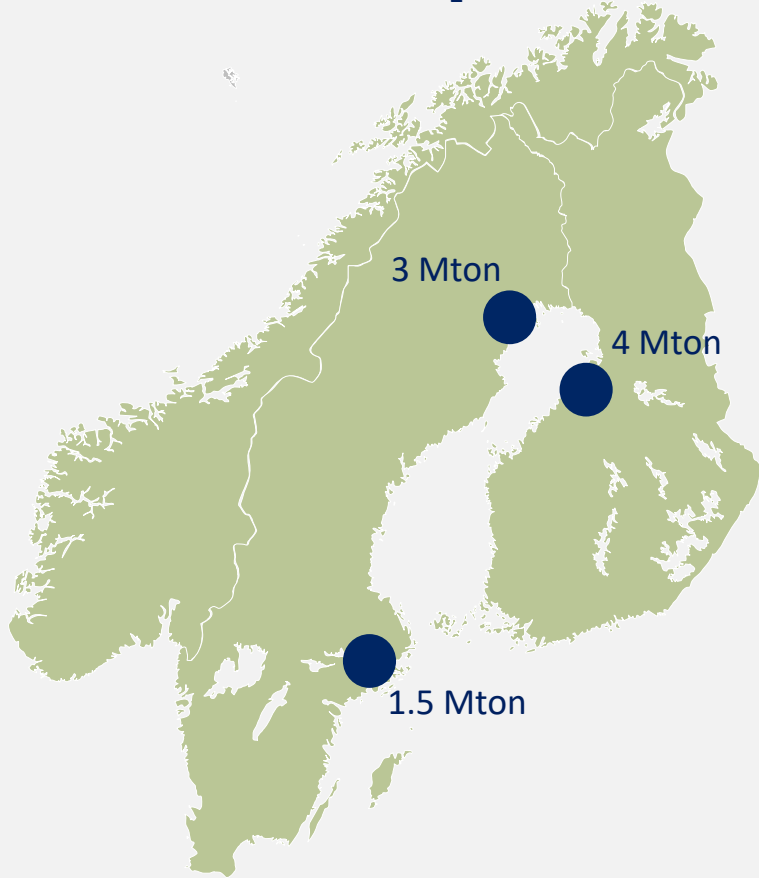
Sustainable operations

Fossil-free by 2045

SSAB will gradually move toward a fossil-free steelmaking process through the HYBRIT initiative and eliminate other emissions related to fossil fuels, making it possible to be fossil-free within the entire operation

HYBRIT – Hydrogen Breakthrough Ironmaking Technology

SSAB blast furnaces – CO₂ emissions



Background

- ▶ SSAB's BF's operate with lowest CO₂-emission worldwide
- ▶ Still SSAB stands for 10% of Sweden's & 7% of Finland's total CO₂ emissions
- ▶ Sweden has a large surplus of fossil-free electricity – large potential to build more
- ▶ Sweden & Finland – world leading R&D competence

The HYBRIT technology

BLAST FURNACE

HYBRIT – a cooperation with Vattenfall & LKAB

Production intensity per tonne of crude steel

Global average

SSAB

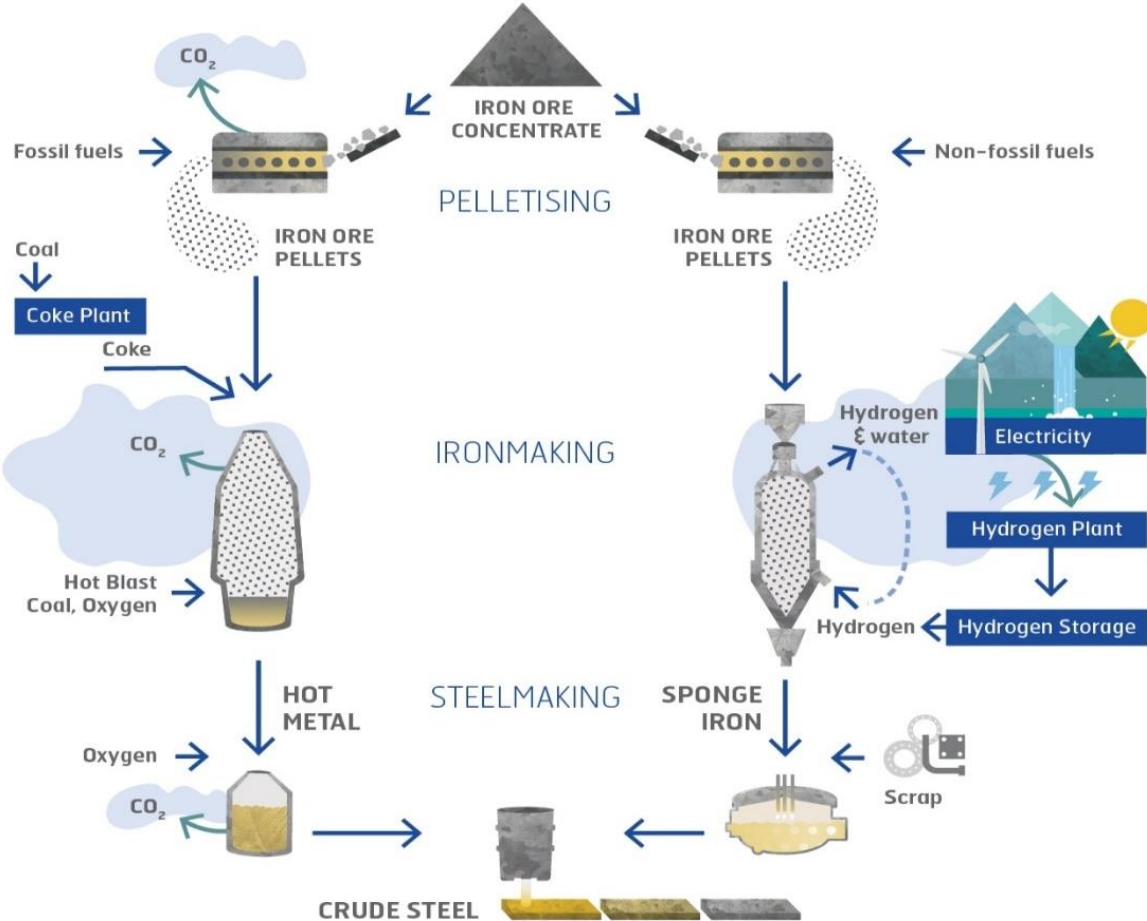
2,000
kg CO₂

1,600
kg CO₂

81
kWh Oil

5,510
kWh Coal

235
kWh Electricity



25
kg CO₂

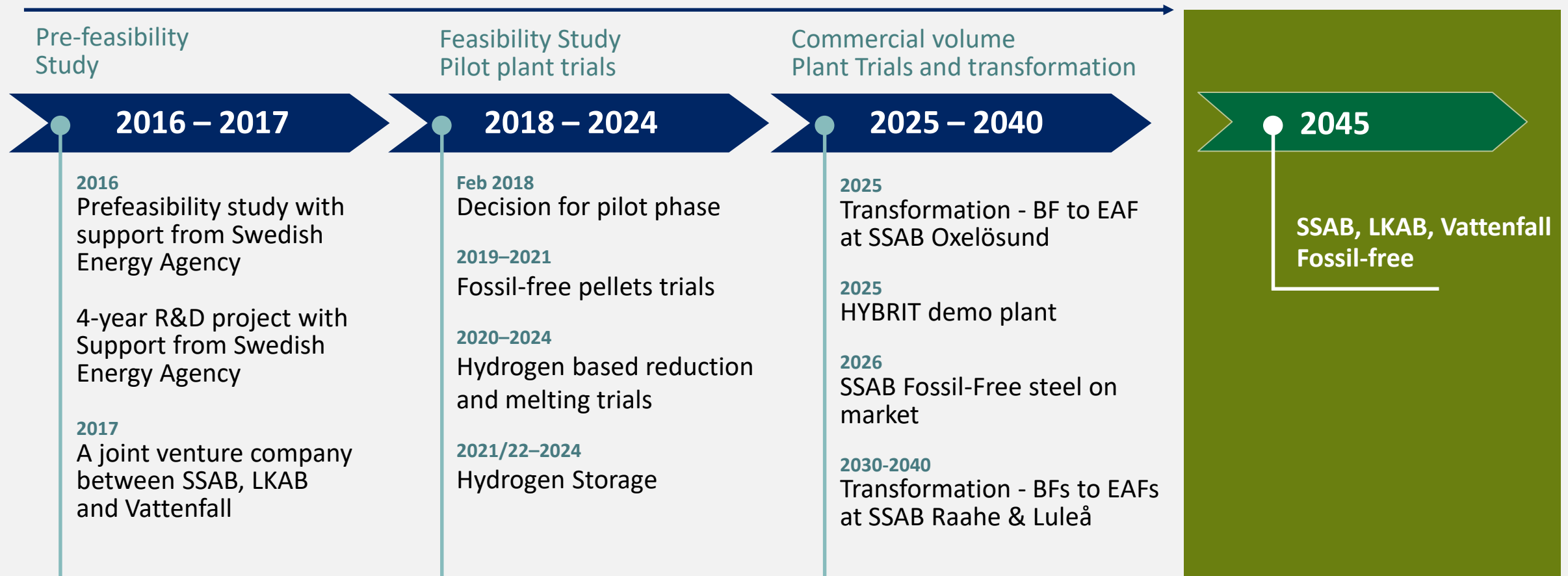
42
kWh Graphite

560
kWh Bio

3,488
kWh Electricity

Roadmap to be first in fossil-free steel

Faster transition possible depending on customer demand



HYBRIT® Initiative – on-going pilot activities



SSAB

LKAB

VATTENFALL

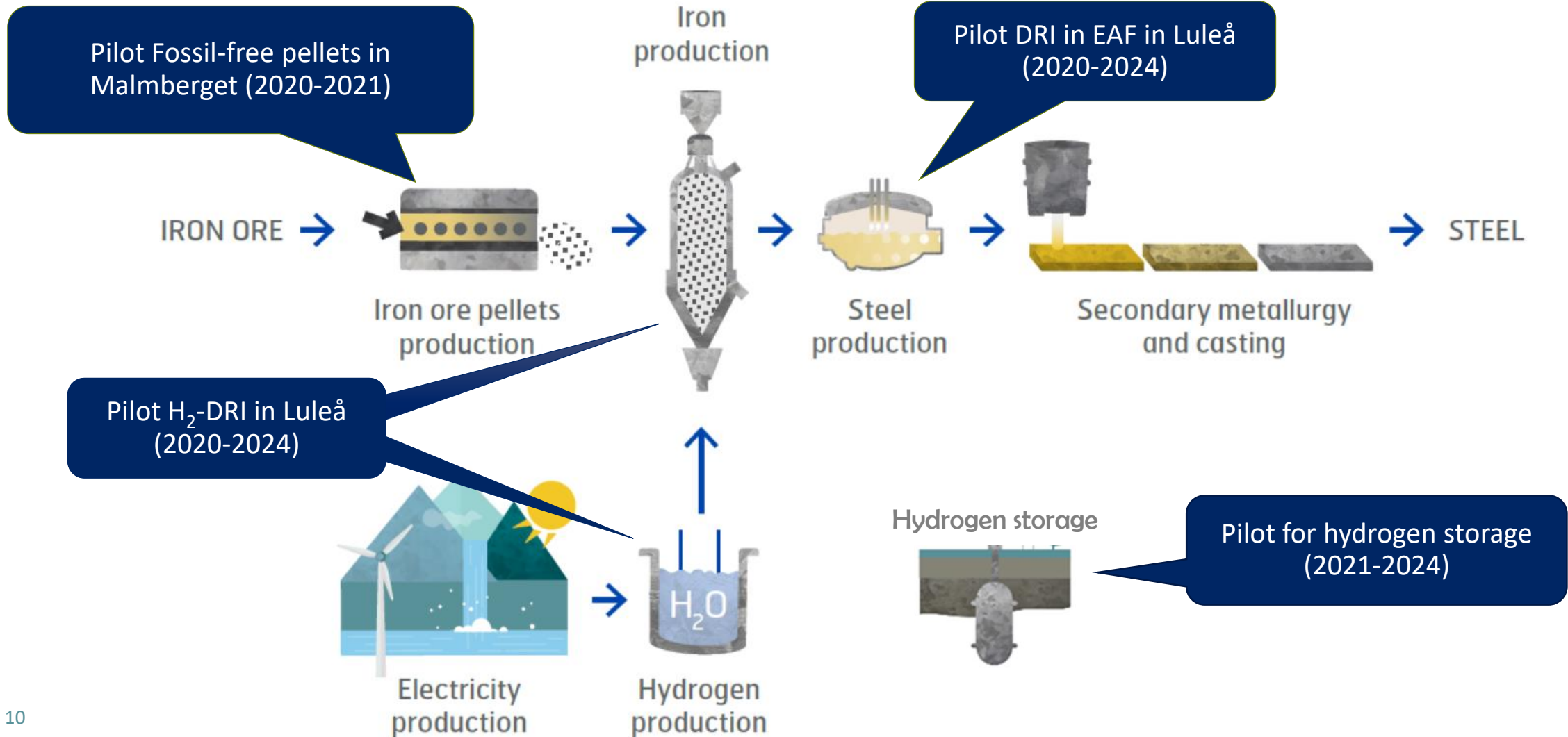


**Swedish
Energy Agency**

Ground-breaking ceremony June 2018 – research and pilot trials worth 140 M euro

A fossil free value chain

HYBRIT's pilot projects in Norrbotten, Sweden





Enablers for shift to net-zero industry - including for HYBRITs industrial demonstration



- ▶ Long-term policy measures leading to net-zero emissions & sustainable growth, jobs, innovation
 - The New Green Deal
 - EU 2050 Long-term Strategy & Climate Law
 - EU Industrial Strategy
- ▶ Access to fossil-free electricity and build-up of critical infrastructure, including for green hydrogen production and storage
- ▶ Financial support, including EU funding, and risk sharing
- ▶ EU ETS system should be designed from 2020 to benefit the most climate-efficient methods from quarrying in the rock to finished steel
- ▶ Development of markets for low-carbon products

HYBRIT

▶▶▶ FOSSIL-FREE STEEL

A joint venture between

SSAB

 **LKAB**

VATTENFALL 