

FIRSTIN FOSSIL FREE STEL

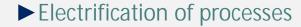


Fossil free by 2045

Addressing the 90% blast furnace related emissions

- HYBRIT initiative
- ➤ Sustainable input materials
- Utilization of residuals

Addressing the 10% fuel and internal transport related emissions



- Increased use of biofuels
- ► Using electric, hybrid or biofuel vehicles

Current emissions: 100% = 10 million tonnes of CO₂



90%

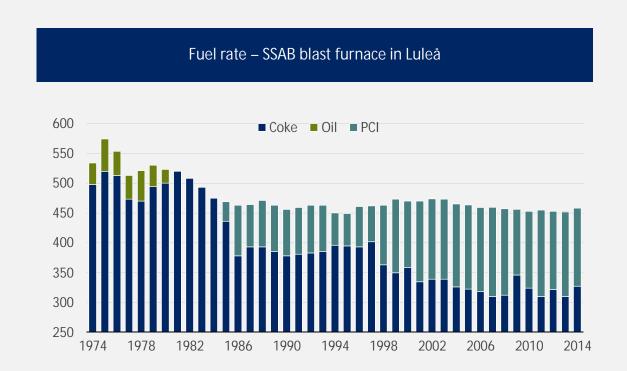
10%



SSAB is already today at the forefront

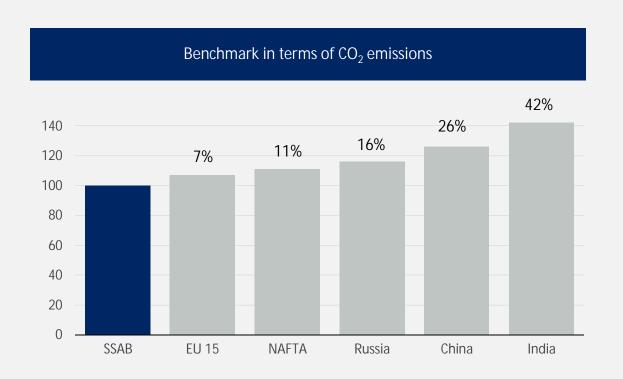
- ➤ Today, SSAB has some of the world's most CO₂-efficient steelmaking operations
- ➤ Step change in the 1980s
 - LKAB development of iron ore pellets
 - SSAB development of the blast furnace (BF) process:
 - Closing sinter plants in Luleå, Oxelösund and Raahe

100% pellets operation in all 5 blast furnaces – unique solution





SSAB is already today at the forefront



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





HYBRIT – Hydrogen Breakthrough Ironmaking Technology



Background

- ▶ Despite being the world's most CO₂-efficient steelmaker, SSAB still accounts for 10% of Sweden's and 7% of Finland's total CO₂ emissions
- Sweden has a large surplus of fossil-free electricity, and a large potential to build more
- ► Sweden and Finland world-leading R&D competence



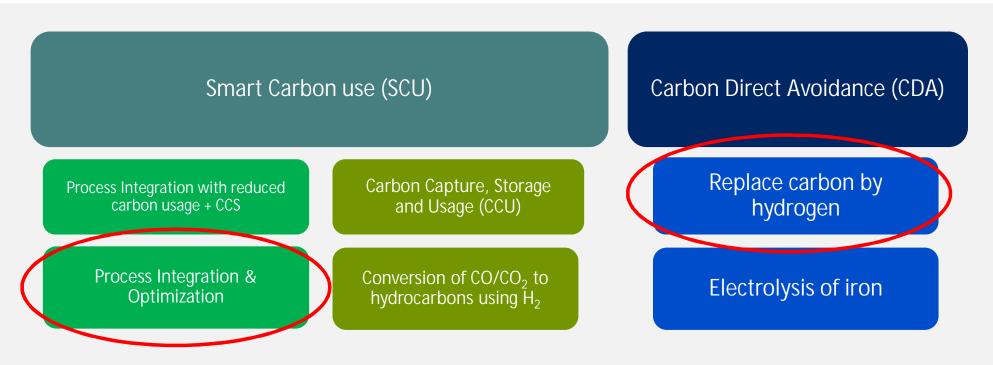
Limited options to further develop blast furnaces

- ► The current blast furnace process is built on coke and other fossil materials
- ➤ Some CO₂ reductions possible in the traditional blast furnace
- ► Storing CO₂





Pathways of European Steel Industry to low CO₂ steelmaking



SSAB first to launch hydrogen based DRI-EAF technology initiative, others in Europe are now following the same path



Breakthrough low- CO_2 iron and steel production initiatives with CDA pathway

Initiative	Description	Actors	Actions
HYBRIT	Direct reduction of iron ore with H ₂ , EAF steelmaking	SSAB, LKAB, Vattenfall	Demo plant under construction at Luleå, Sweden
SALCOS	$\rm H_2$ based DRI-EAF steelmaking, linked with GrInHy $\rm H_2$ production project	Saltzgitter, Fraunhofer	Demo plant under construction in Salzgitter, Germany
SUSTEEL / H2FUTURE	DRI-EAF steelmaking, Hydrogen Plasma Smelting Reduction (HPSR process)	Voestalpine, K1-MET Primetals, MUL	Laboratory scale tests at voestalpine Donawitz, PEM H ₂ electrolysis plant at Linz, Austria
IN4Climate	BF process with H ₂ reduction, DR-EAF route	Thyssen, AirLiquide	Tests at Thyssen Duisburg, Germany
SIDERWIN	Steelmaking through reduction of iron oxides with electrolysis	ArcelorMittal, 12 research units	H2020 project

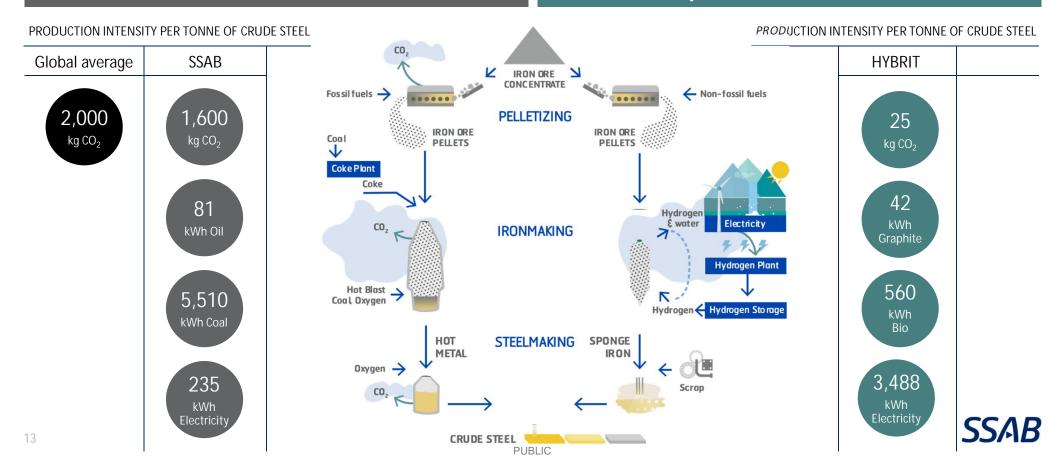


Traditional versus HYBRIT technology



BLAST FURNACE

HYBRIT – a joint venture with Vattenfall and LKAB



Roadmap to be first in fossil-free steel

Faster transition possible depending on customer demand

Pre-feasibility study

Feasibility study Pilot plant trials

Commercial volume Plant trials and transformation

2016 – 2017

2016

Prefeasibility study with support from Swedish **Energy Agency**

4-year R&D project with Support from Swedish **Energy Agency**

2017

A joint venture company between SSAB, LKAB and Vattenfall

2018 - 2024

Feb 2018 Decision for pilot phase

2019-2021

Fossil-free pellets trials

2020-2024

Hydrogen based reduction and melting trials

2021/22-2024

Hydrogen storage

2025 - 2040

2025

Transformation – BF to FAF at SSAB Oxelösund

2025

HYBRIT demo plant built

2026

SSAB fossil-free steel on market

2030-2040

Transformation – BFs to **FAFs at SSAB Raahe and** Luleå

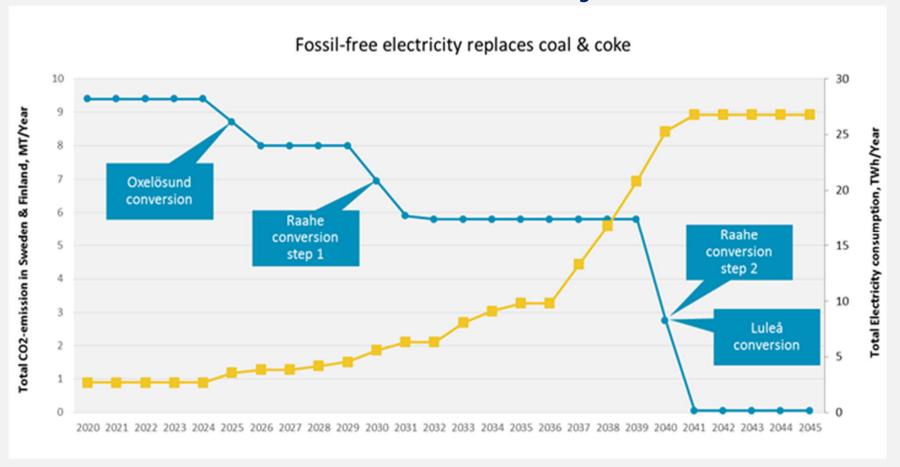
SSAB Fossil free

2045

BF = blast furnace, EAF = electric arc furnace



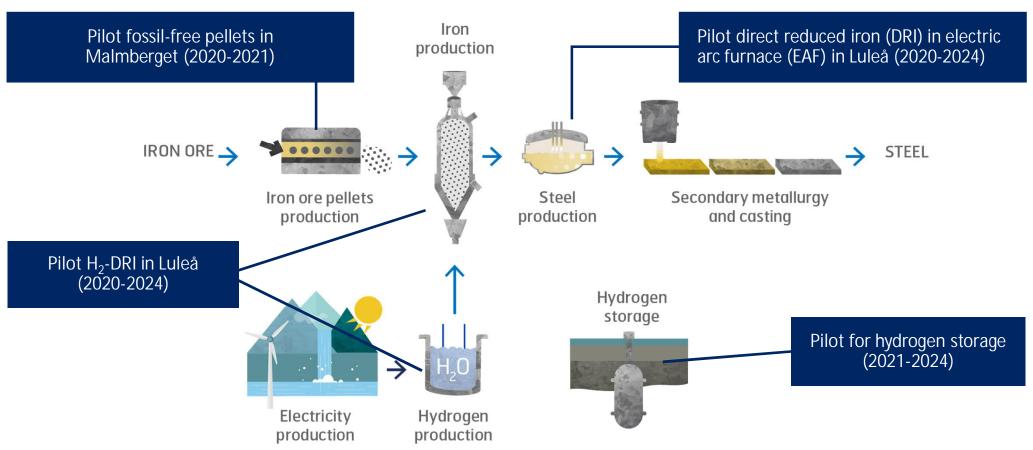
SSAB's timeline to be fossil free by 2045





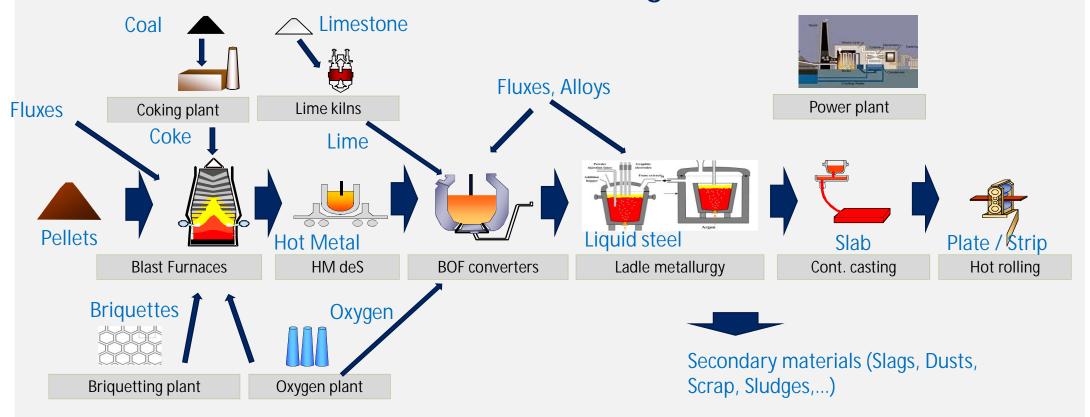
A fossil-free value chain

HYBRIT pilot projects in Norrbotten, Sweden



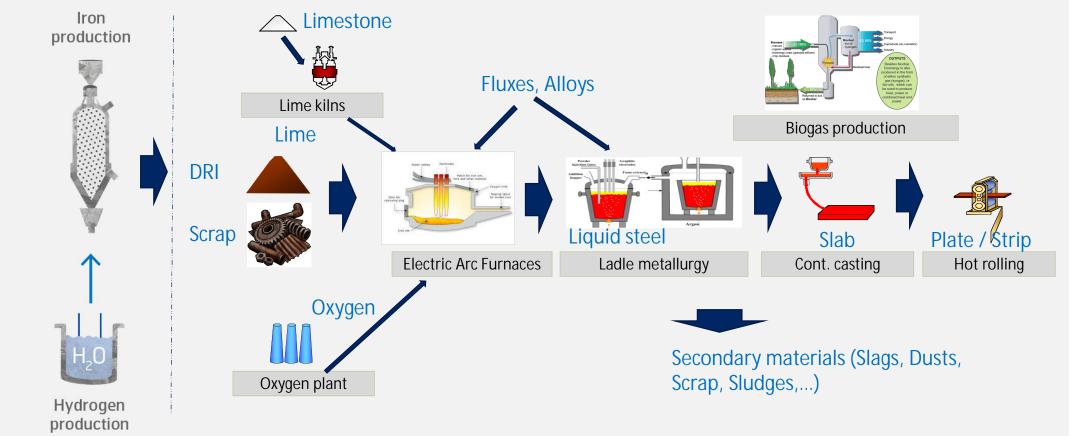
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SSAB Raahe Iron and Steelmaking Process



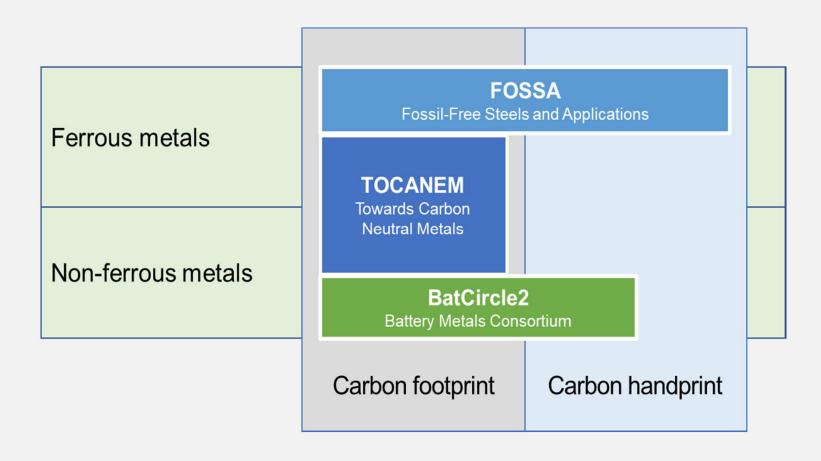


SSAB Raahe process with HYBRIT concept





Metallinjalostajat – Finnish Metals Producers' proposal to Business Finland for R&D program aiming towards Carbon Neutral Finland 2035





FOSSA – Fossil-free steel & Steel applicatinos

