

HYBRIT – A Swedish industrial development project for CO₂-free ironmaking

Martin Pei, EVP & CTO
SSAB AB

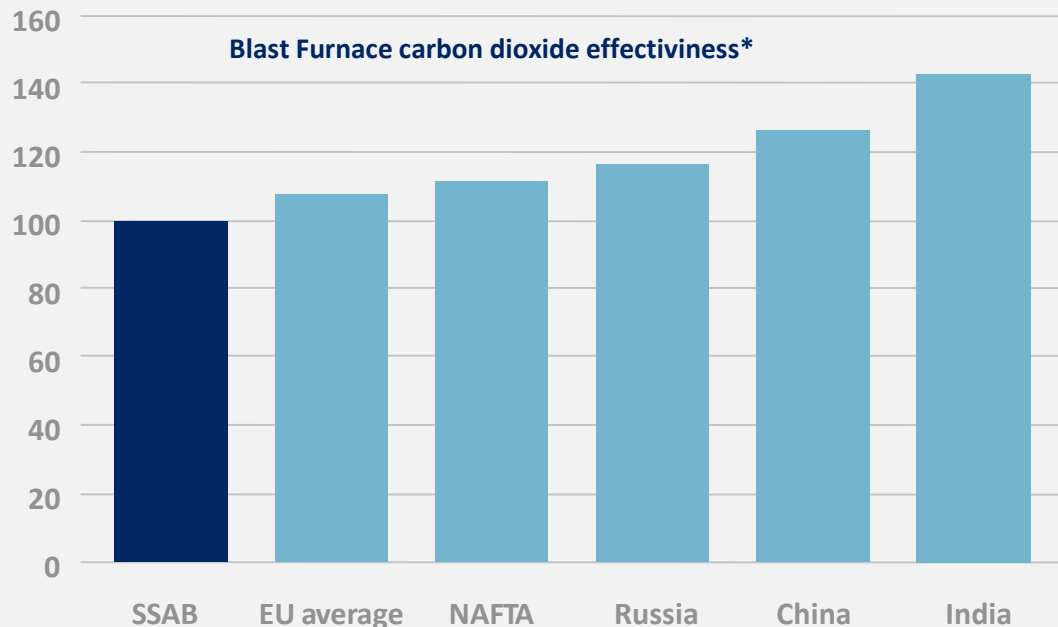
February 17, 2017

Swedish experience in reducing CO₂-emission from iron and steel industry

► Sweden has the most CO₂ efficient blast furnace technology in the world

– SSAB's blast furnace in Luleå:

- Long history of developing ironmaking technologies
- Sinter plant shut down in 1978 → 100% pellets operation: FR 520-530 kg/thm
- 1982 LKAB olivine pellets, 1985 PCI: FR 460-470 kg/thm
- Increase PCI capacity 1998, continuous process optimization: FR 450-460 kg/thm



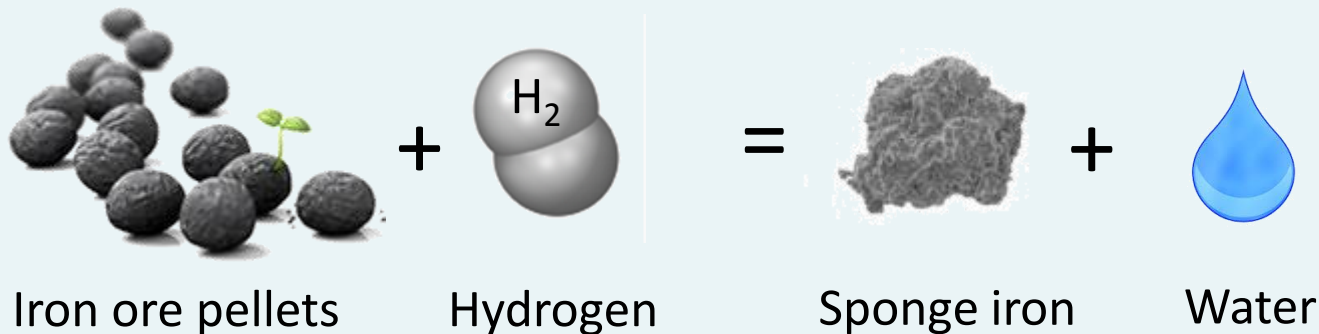
Source: Stahl-Zentrum. *The carbon dioxide effectiveness index for ironmaking was based on 2012 years consumption data

Sweden has a unique opportunity

- ▶ Sweden has a clean electricity supply:
 - Already today with fossil free energy system, with excess capacity
 - Great potential in renewable energy resources, especially in northern Sweden
 - Multi-party agreement in Sweden: energy system zero GHG emission in 2045
- ▶ Swedish parliament has decided to become the first welfare state to reach net zero emission in 2045
- ▶ To reach the zero emission goal, breakthrough technology is necessary to replace carbon as the reducing agent for ironmaking

Hydrogen Breakthrough Ironmaking Technology

- ▶ CEOs of SSAB, LKAB and Vattenfall, in the presence of Swedish Minister for Enterprise and Innovation, launched on April 4, 2016, a joint development project that, if proven feasible, can solve the root cause of the steel industry's CO₂ challenge.
- ▶ The aim is to replace the blast furnace and eliminate CO₂ emissions from ironmaking, by using hydrogen produced from “clean” electricity.
- ▶ The by-product from iron ore reduction would be **water**:

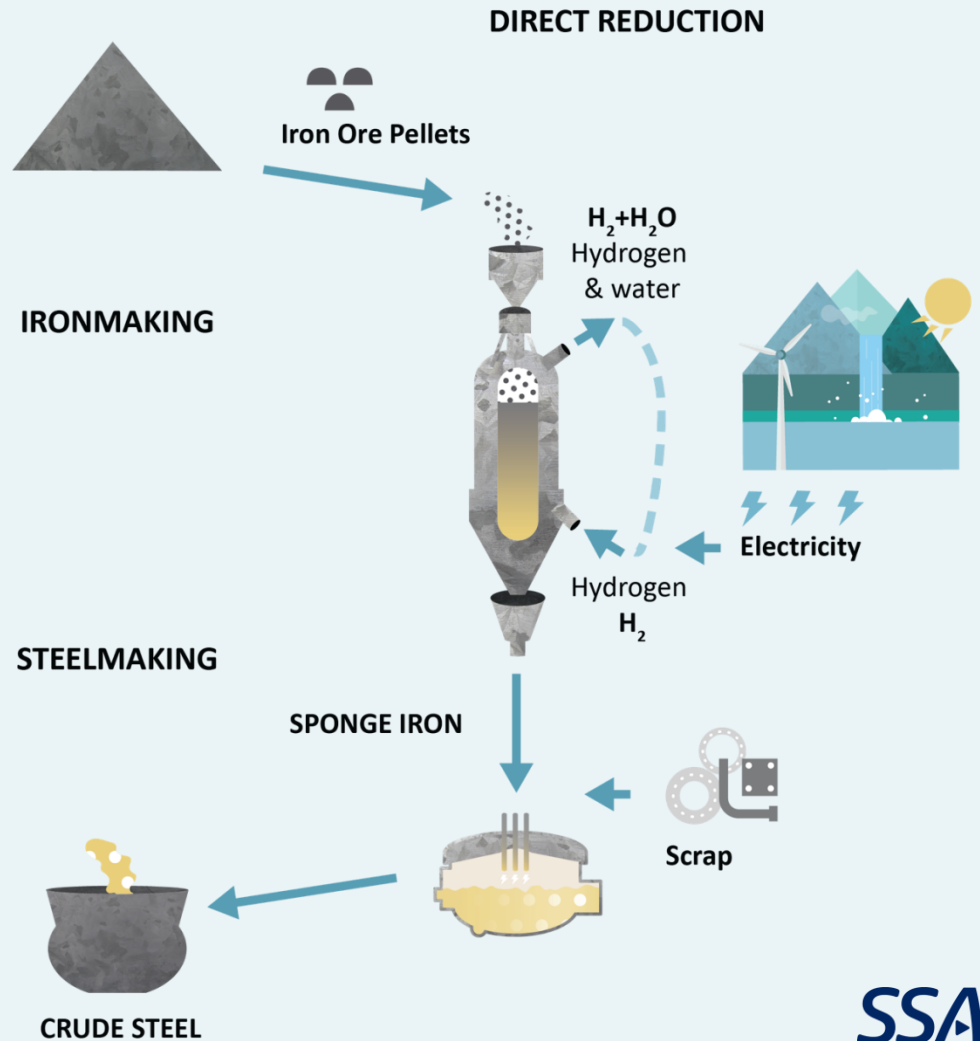


HYBRIT: CO₂-emission free ironmaking

Pre-feasibility study (PFS)
2016-2017

Feasibility study:
pilot plant trials
2018-2024

Demonstration plant trials
2025-2035



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Long term support is needed to succeed

Long term support is needed in all phases of development work, as well as in enabling competitive conditions and energy policy during this transformation:

- ▶ Policies securing the steel industries capability of survival and possibility to invest in this breakthrough technology
- ▶ Financial support in the form of grants and low interest loans to enable the development of this breakthrough technology as well as the transition from current technology

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*A stronger,
lighter and more
sustainable world*