

A close-up photograph of a person's hand resting on a black steering wheel. The person is wearing a dark blue jacket. A large, white, curved graphic element is positioned on the left side of the image, partially obscuring the steering wheel and the person's arm. The background shows the interior of a vehicle, including the dashboard and a digital display screen.

# SSAB's Transformation to a Fossil Free Steel with HYBRIT

Martin Pei, SSAB CTO  
Sept 23, 2022

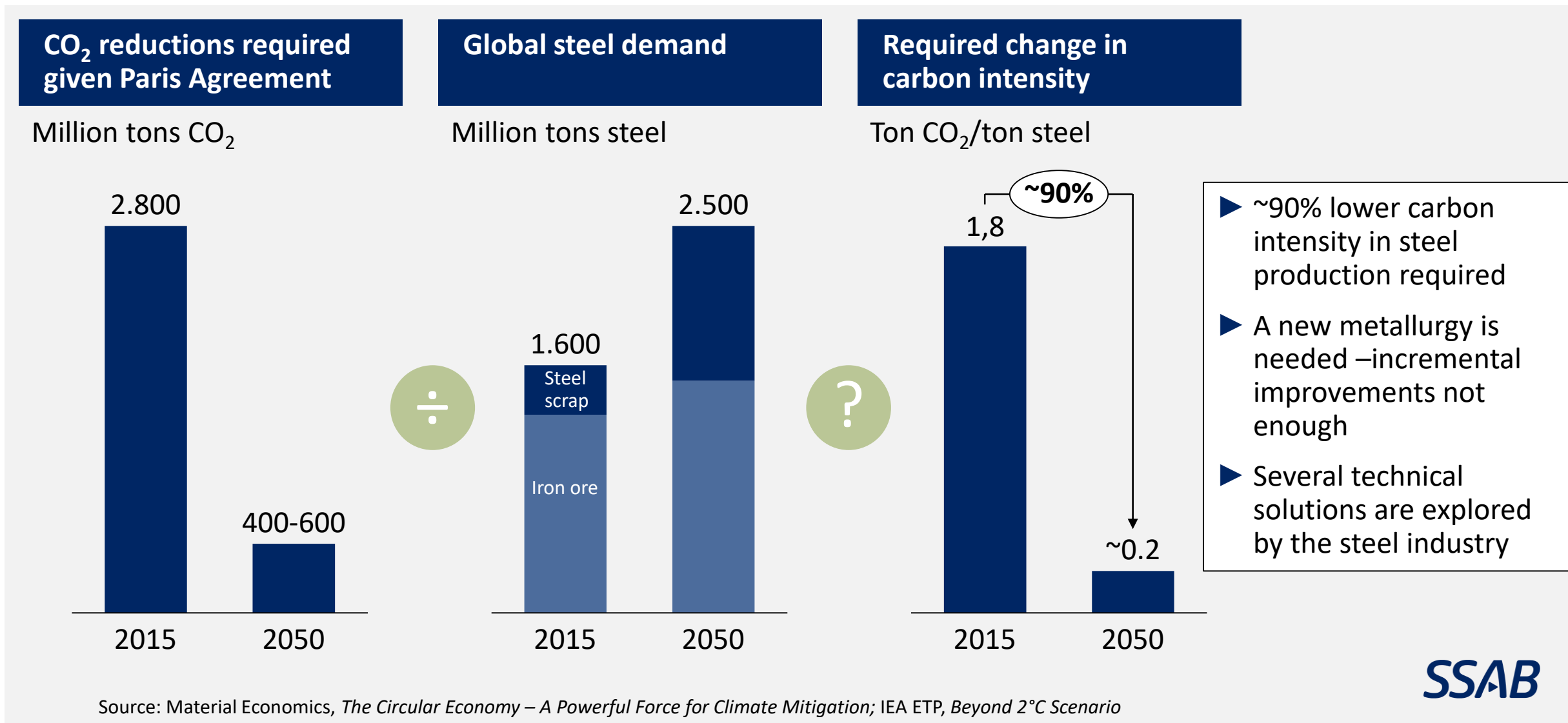
**SSAB**

# Steel is one of the most important materials

- ▶ Critical for society and new infrastructure
- ▶ Unique material and available everywhere
- ▶ 100% recyclable, again and again
- ▶ Global steel consumption per capita is foreseen to further increase as more countries modernize
- ▶ Current production technology from iron ore emits large amounts of CO<sub>2</sub> into the atmosphere



# A breakthrough in steelmaking technology is needed



# HYBRIT – Hydrogen Breakthrough Ironmaking Technology

SSAB blast furnaces – CO<sub>2</sub> emissions

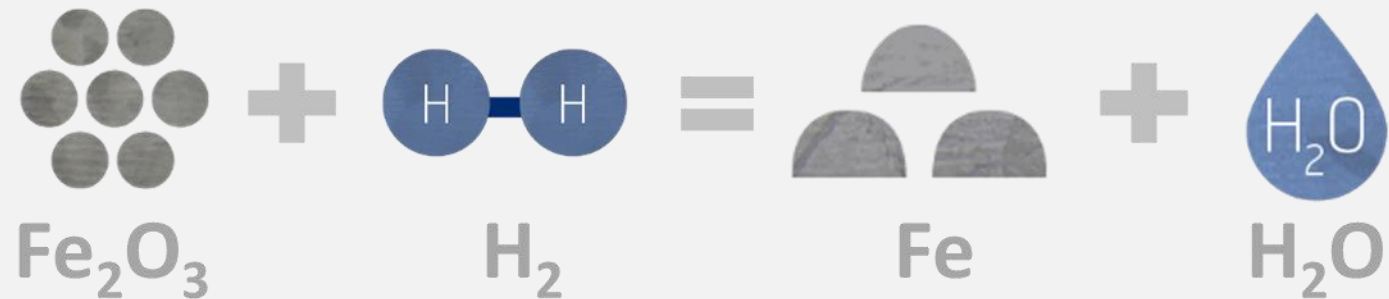


## Background

- ▶ SSAB's blast furnaces operate with lowest CO<sub>2</sub> emissions worldwide
- ▶ Still SSAB accounts for 10% of Sweden's & 7% of Finland's total CO<sub>2</sub> emissions
- ▶ Sweden has a large surplus of fossil-free electricity – large potential to build more wind power mills
- ▶ Sweden & Finland – world leading R&D competence
- ▶ Long tradition of cooperation

# The aim of the HYBRIT<sup>®</sup> Initiative

Eliminate CO<sub>2</sub> emissions in the value-chain for iron- and steelmaking by replacing coal with fossil-free electricity and hydrogen



# HYBRIT – a SSAB initiated joint venture with the target to develop the world's first fossil-free steel-making value chain

# HYBRIT

▶▶▶ FOSTIL-FREE STEEL



Research  
funding from:



- ▶ HYBRIT is a joint venture between SSAB, LKAB and Vattenfall, formed to develop hydrogen-based production of fossil-free sponge iron
  - Initiated by SSAB in 2016, JV company founded 2017
  - Equal ownership stakes of the founding partners
- ▶ HYBRIT R&D supported by government
  - Funding support so far from Swedish Energy Agency
- ▶ In beginning of 2018, decision was made to invest in pilot plant projects based on the HYBRIT Pre-Feasibility Study conclusions



# The HYBRIT technology

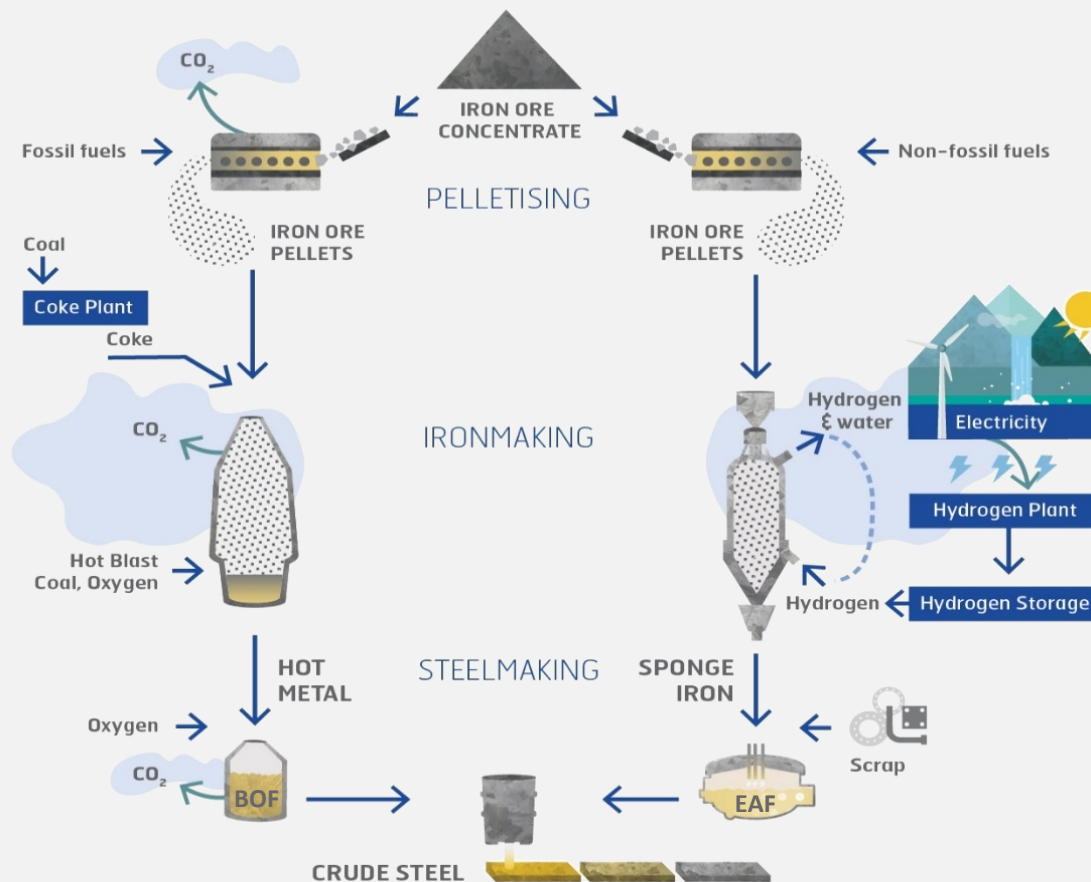
## CURRENT PROCESS - BLAST FURNACE + BOF

1,600  
kg CO<sub>2</sub>

19,836  
MJ Coal

235  
kWh Electricity

292  
MJ Oil



25  
kg CO<sub>2</sub>

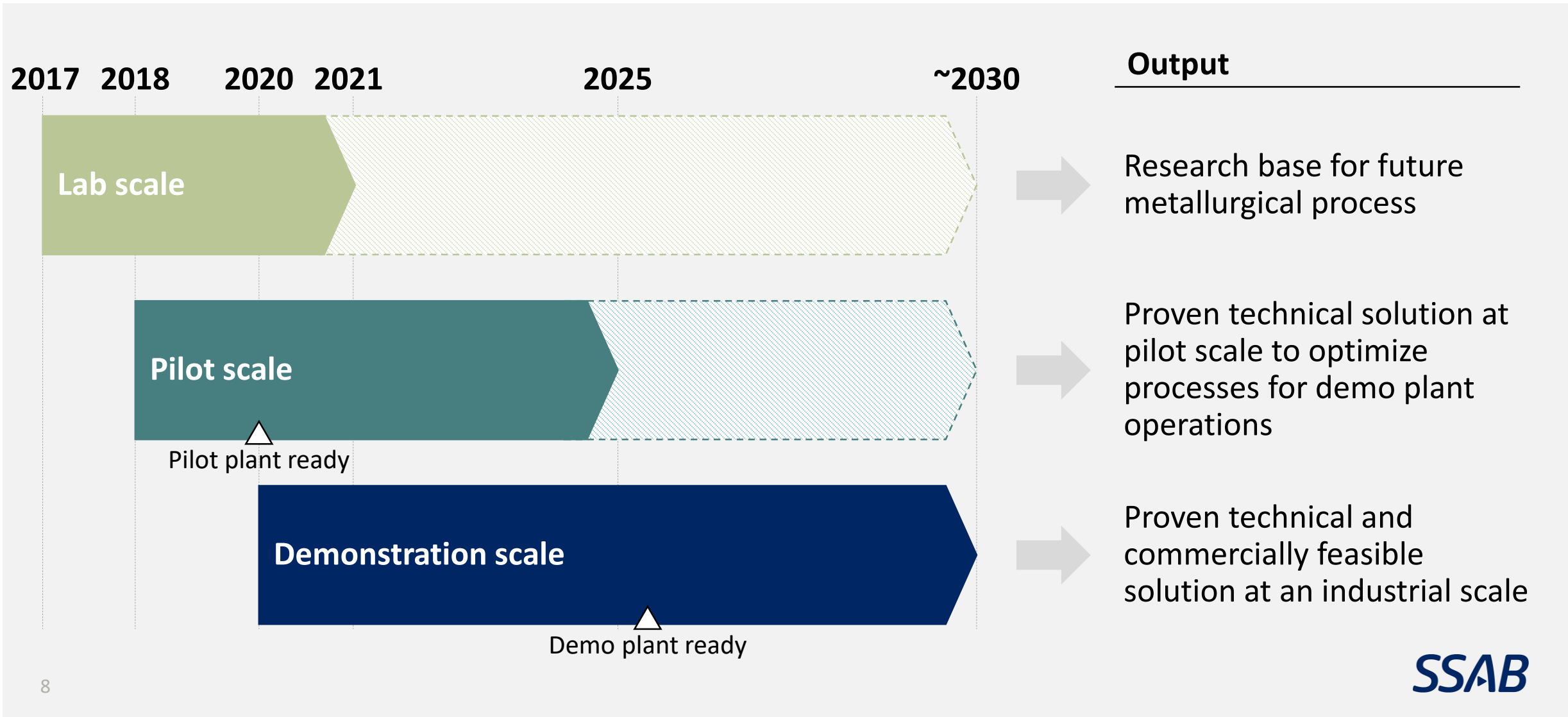
151  
MJ Carbon

3,488  
kWh Electricity

2016  
MJ Bio

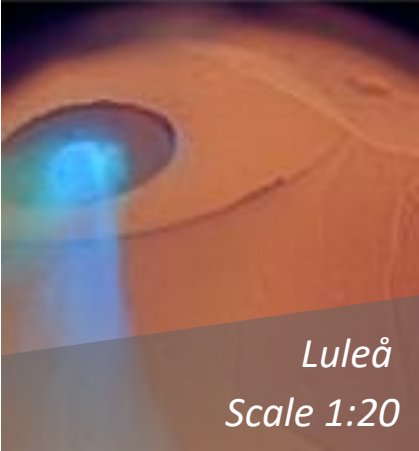




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# HYBRIT development phases – to industrial scale





# HYBRIT's pilot projects covering the whole value chain

| Alternative heating technique for sintering of pellets   | Pellets production with bio-oil  | Energy storage LRC for hydrogen  | Direct reduction with fossil free hydrogen   | Melting of DRI/HBI in EAF   |
|--|--|--|--|---|
|  <p>Luleå<br/>Scale 1:20</p> |  <p>Malmberget<br/>Full scale</p> |  <p>Luleå<br/>Volume 100 m<sup>3</sup></p> |  <p>Luleå<br/>Capacity 1 ton/h</p> |  <p>Luleå<br/>Capacity 10 ton</p> |
| Fossil free heating replacing coal & oil for sintering of iron ore pellets                                     |  | Hydrogen storage important component for future electricity grid with more wind/solar  | H <sub>2</sub> replacing C for iron ore reduction, resulting in H <sub>2</sub> O instead of CO <sub>2</sub>            | Fossil free melting & refining from iron to steel   |

# HYBRIT – Successful pilot trial of 100% H<sub>2</sub>-reduced DRI/HBI

June 21, 2021





# SSAB – First pilot delivery of steel made from HYBRIT-DRI/HBI

Aug 18, 2021



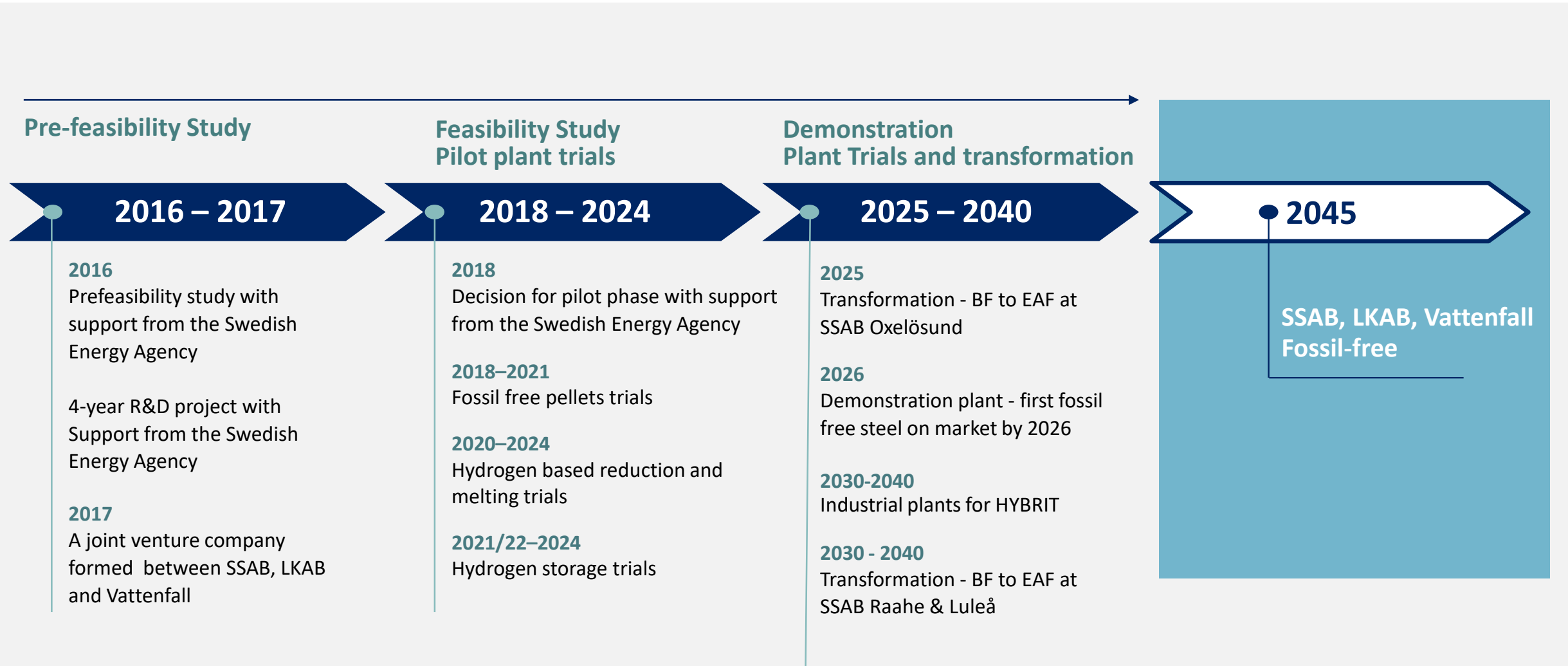


# Volvo launches world's first vehicle using fossil-free steel

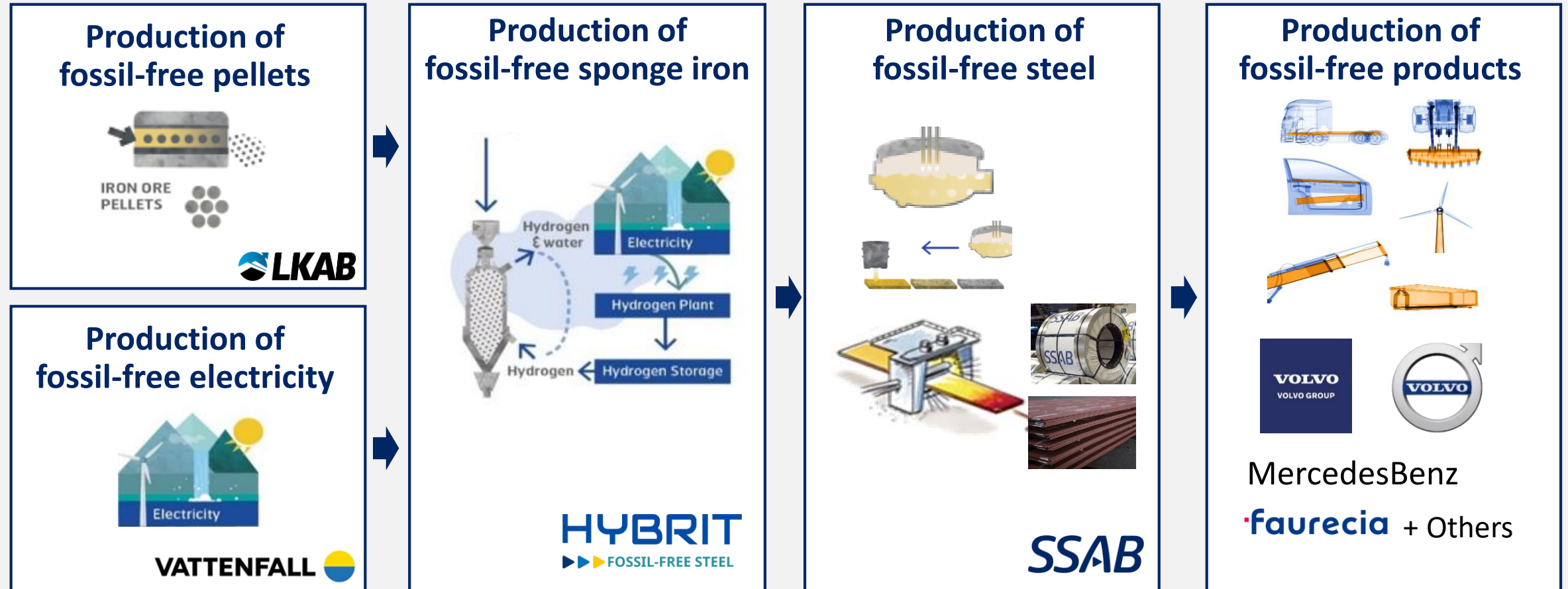
Oct 13, 2021 (Tara) in 2022 the A30 truck to NCC



# Roadmap launched in 2018



# Strategic partnerships secures the most cost efficient production from ore to fossil free steel products

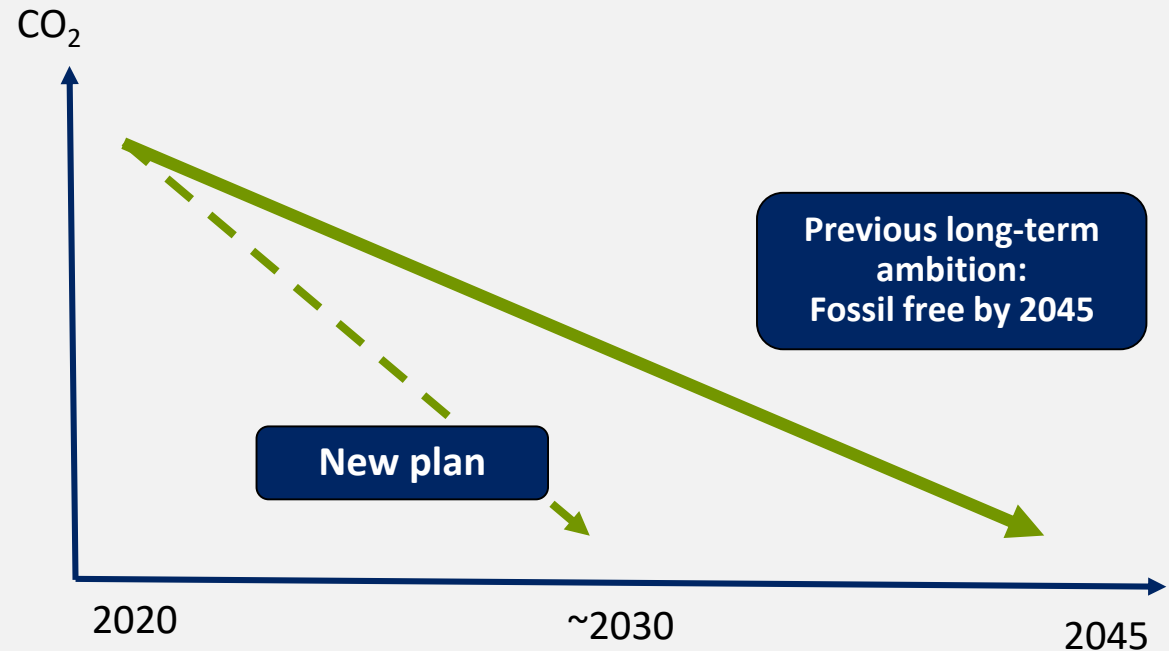


**SSAB**



# SSAB accelerates the green transition by 15 years: Jan 2022

- ▶ Answer to strongly growing demand for fossil-free steel
- ▶ Offering our customers to be part of a fossil-free value chain
- ▶ Mitigating climate change
  - Contributing to climate targets in Sweden and Finland
  - 8 million tonnes less CO<sub>2</sub> emissions per year



\*Graph for illustrative purposes

# Transformation of the Nordic strip production system

- ▶ Expanding product range
  - Grades, dimensions and quality,
  - Keeping current specialty and premium strategy
- ▶ Building one mini-mill in Luleå and one in Raahe
  - Both mills to be built fossil-free from start, including power supply
  - Capability to run a flexible load of DRI/HBI and recycled scrap
  - 2.5+ MT each, in line with current capacity
- ▶ Complete transformation during the next ~10 years
  - Strategic investment program of SEK ~45bn
  - Ability to fund transition with own cash flow
  - Reduced maintenance capex and modernization needs

**A broader offering  
of fossil-free  
products**

**A step change in  
efficiency and  
flexibility**

***SSAB***



*A stronger,  
lighter and more  
sustainable world*