Heating steel with hydrogen and oxygen

2020-11-11 Göran Nyström, EVP Ovako Group

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Bergsmannaföreningen ry

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Nippon Steel - Sanyo Special Steel - Ovako - Global leaders in long products special steel

- World-leading position
  - Products and capacity
  - Security of supply
  - R&D
  - Staying power
  - Global reach

- Steelworks:
  - Sweden
  - Finland
  - Japan
  - India

- 10,000 employees
  - Group total ~100,000
- 6 million tonnes (Mt) production capacity
  - Group total ~50 Mt

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Ovako in Imatra

Steel is a foundation to our societies
- but there are BIG differences between steel and steel

Ovako's vision:
"Innovative steel for a better engineered future"

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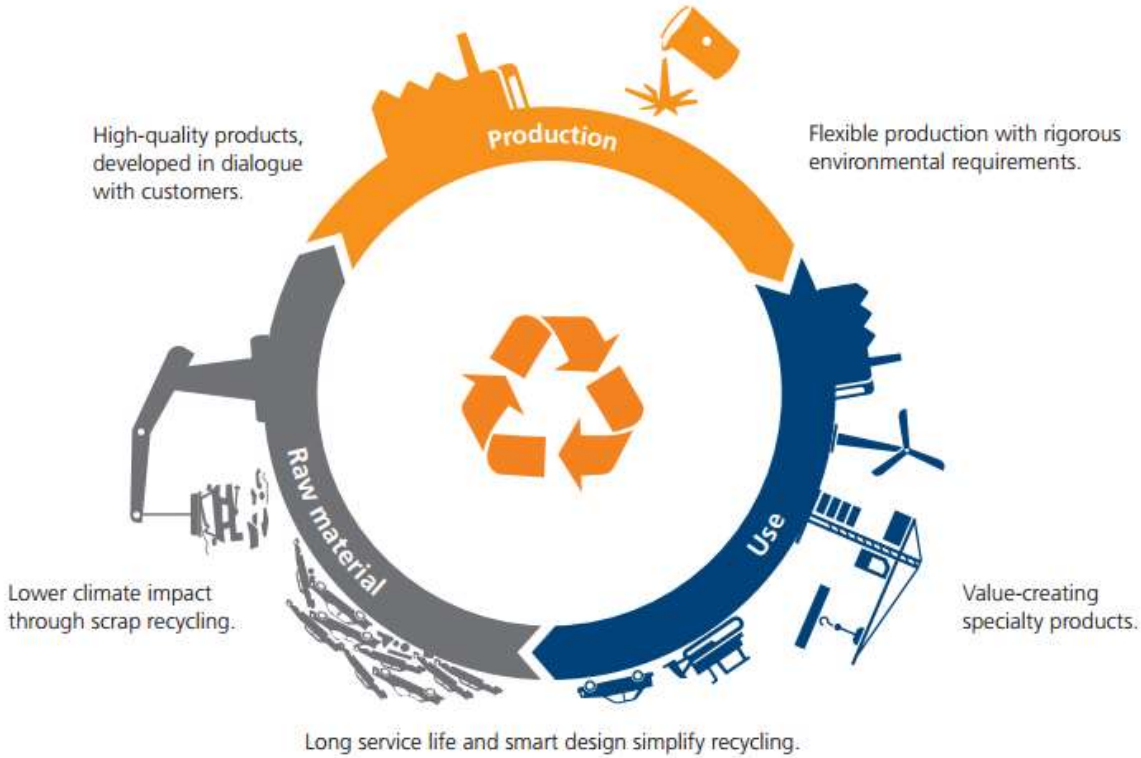
Leadership in sustainable steel:
Carbon footprint & product use phase & recyclability



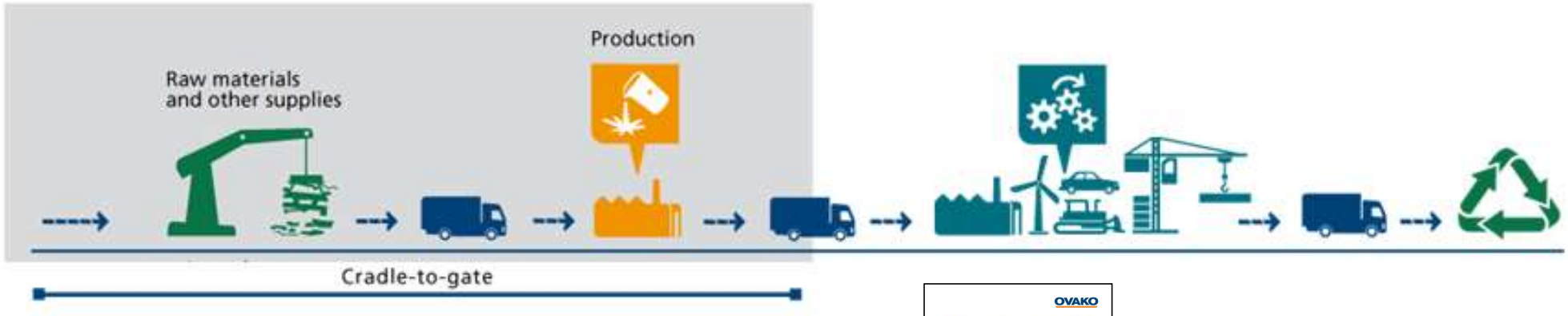
Wind Power
Ovako clean steel for bearings for main shafts

- One third of 20,000 wind turbines (installed 2019) featured large bearing rings in Ovako clean steel
  - Plus other components in steel from Ovako

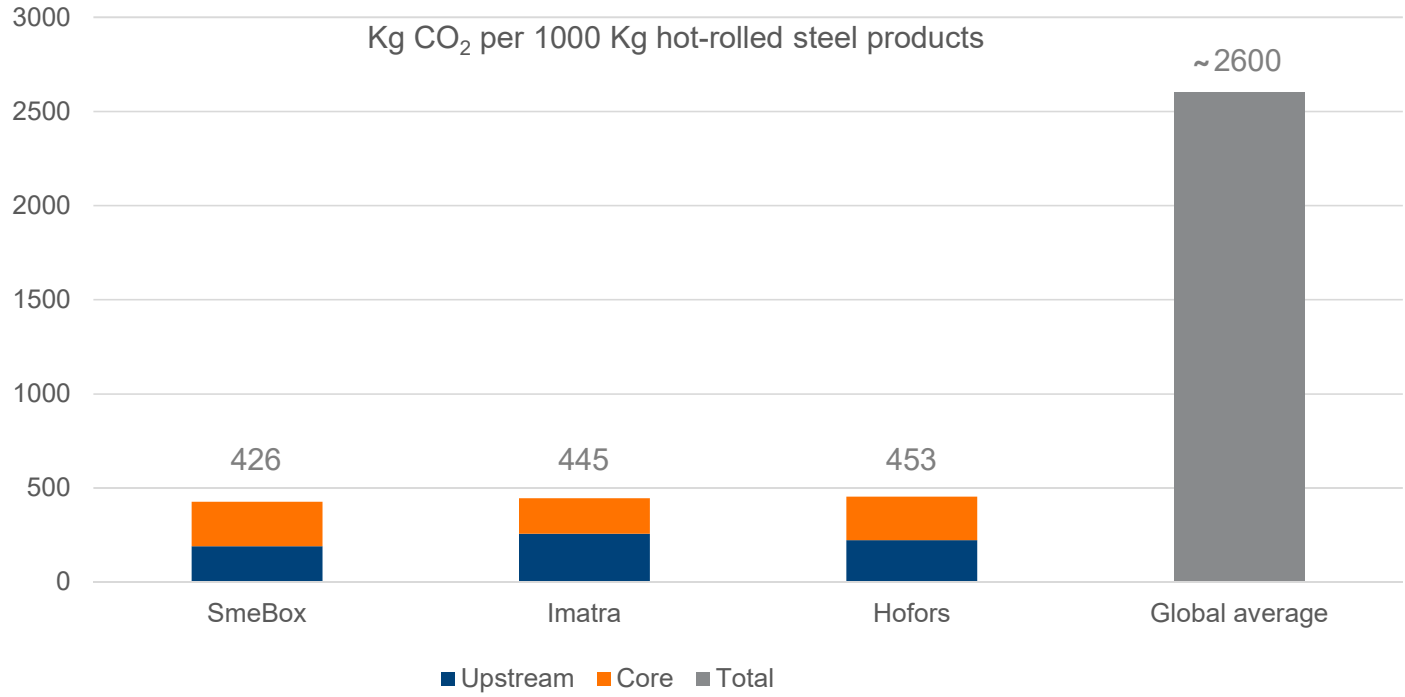
- A wind turbine is expected to remain in service for at least 20 years (depending on the quality of the materials used in its construction)

→ One year's supply of Ovako clean steel rings enables life time savings of 260 Mt of CO_2

Carbon dioxide footprint, “cradle-to-gate”-perspective - a question of responsibility and measurability



Ovako provides a distinct advantage: Two tons of CO_2 saved for every ton of steel



OVAKO VS. GLOBAL AVERAGE

Sources: Climate declarations and company estimates, verified by KPMG

Heating steel with hydrogen and oxygen from electrolysers – short summary

- A world first full-scale experiment in Hofors in March 2020
- Applicable to all industries heating steel for hot-working
- A very large potential global impact
- Large reductions possible already from 2022 – if we act swiftly
- Already today a viable economical solution on variable costs
- No storage of hydrogen - propane or natural gas is the buffer
- Important effects on electricity grid
- Could create a grid of hydrogen stations for fuel cell powered vehicles

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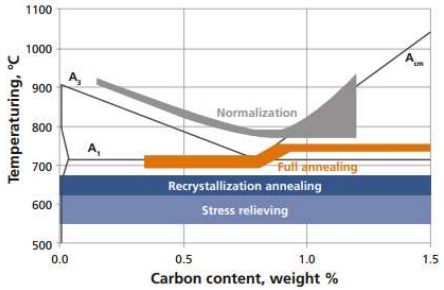
Ovako's furnace landscape holds one last remaining large area for electrification

- ✓ Melting of steel

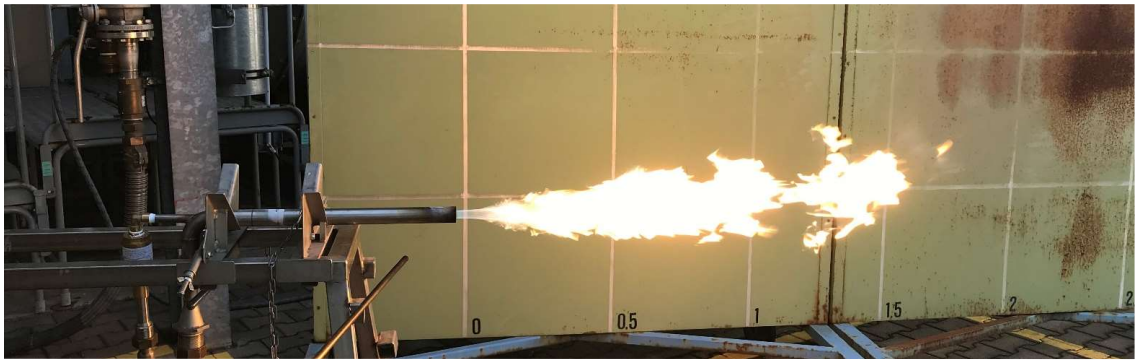
- → Heating of steel for hot-working

- ✓ Heat treatment for product properties

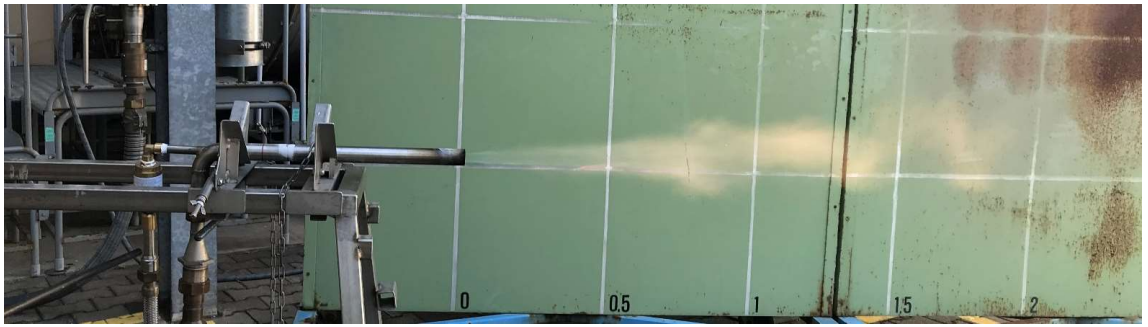


Pre-trials in Munich, Linde lab Lohof, September 2019

Propane
+ oxygen



Hydrogen
+ oxygen



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Trials in Stockholm, Linde lab Älvsjö, October 2019

Steel samples for four different applications were heated with H_2-O_2 and LPG-O_2 (as reference).

”Probably the First Fossil free heating in the world”

99% H_2O in furnace atmosphere

No quality issues for any steel grades

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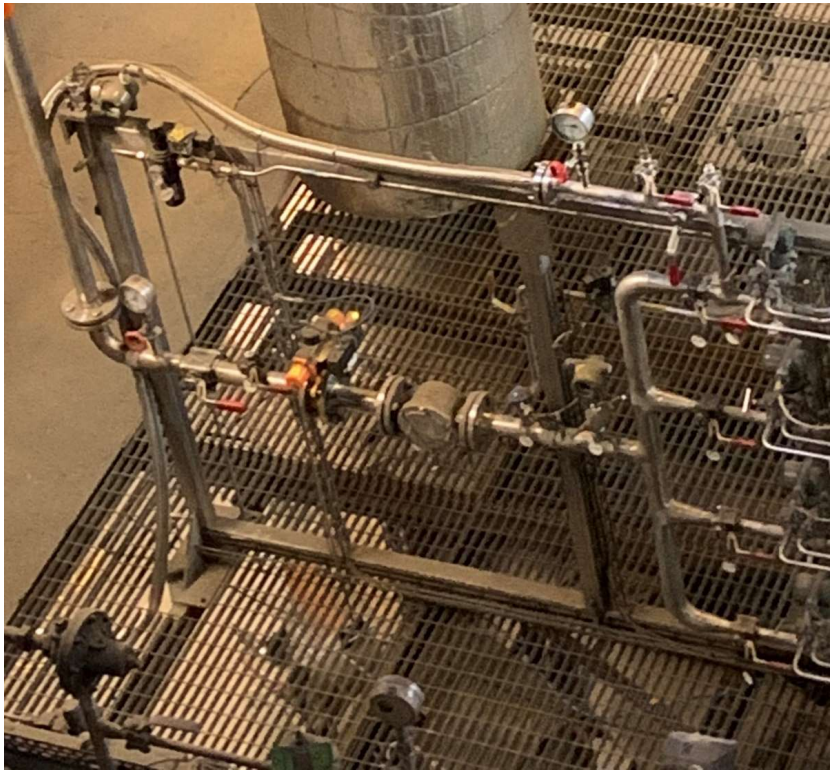
H_2 tied into LPG flow train (2 barg vs 1 barg for LPG)

147 *50 l cylinders, 200 bar(g)

Pressure reducer to 2 bar(g) and slam shut

Tie-in to existing LPG flow train



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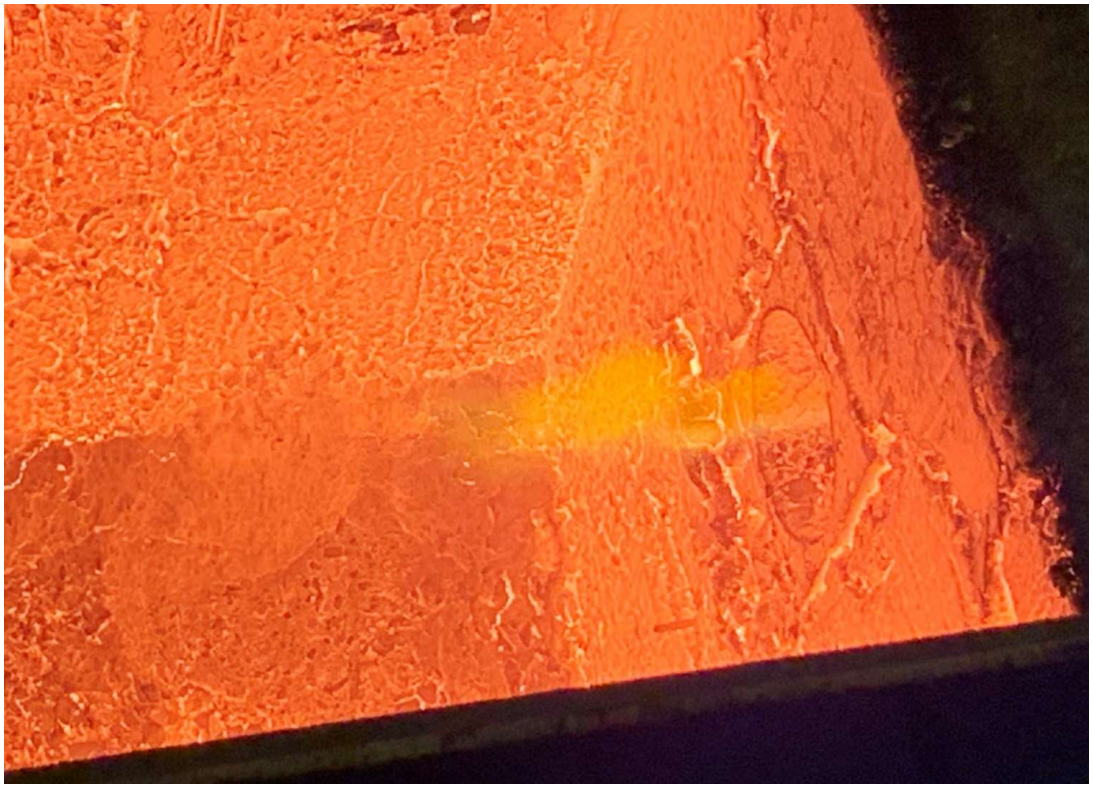
Oxy-H_2 firing

In pit before charging



In Lab, flame less mode

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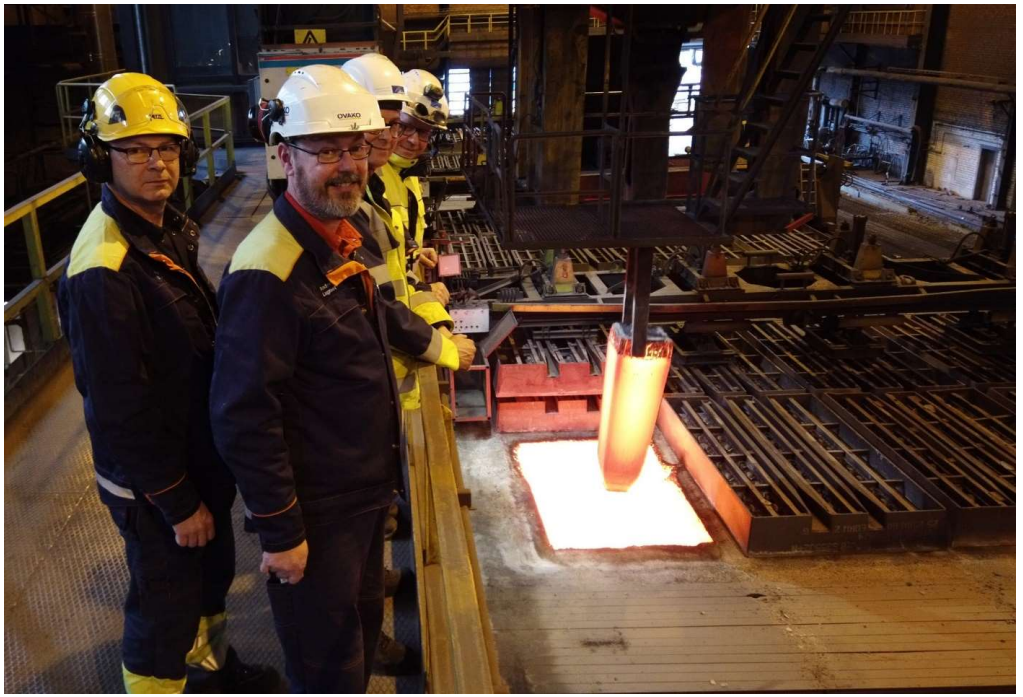
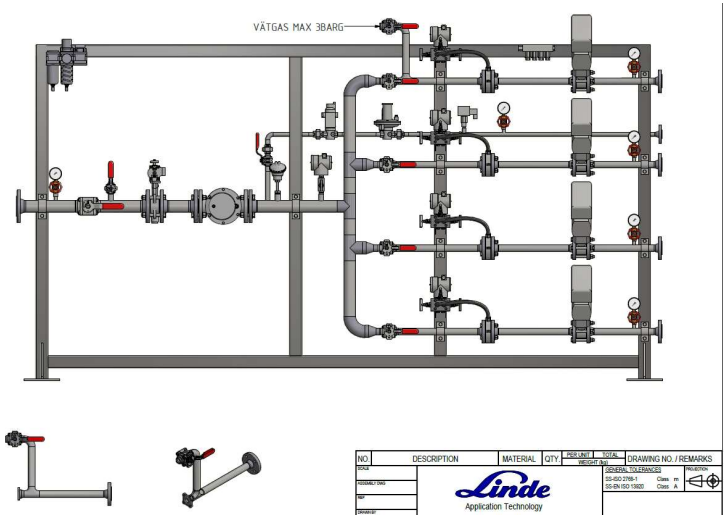
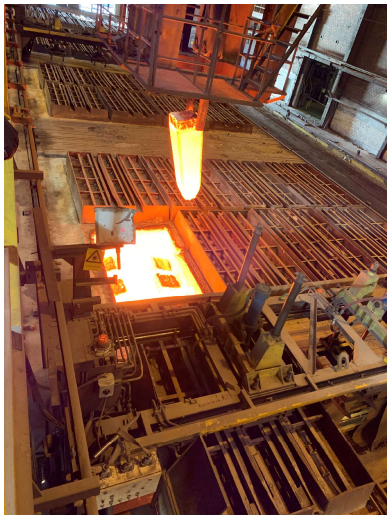
Charging (6 x 4,2 ton ingots/cell) bearing steel 100Cr6



2020-03-18: First fossil-free heated steel in the world





- One electrolyser (3500 Nm3/h) can reduce CO2 with 20 Kt/year
  - Ovako total >100,000 t/yr CO2
- True electricity flexibility. Natural gas or propane is an instantaneous back-up
- We can also fuel internal transports + allow external ”hydrogen gas station”
- A proven concept can be copied to steel industries in EU and worldwide
  - Global total >300,000,000 t/yr CO2

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Strong interest from all around the world

Ovako, 세계 최초 수소 연료로 강재 가열

압연 공정에 LPG 대신 수소 연료 사용
기존 설비 활용...강철 품질은 이상 無

월간수소경제 편집부 master@h2news.kr | 등록 2020.05.07 17:20:10

▲ 경제성만 갖춘다면 수소 연료는 제철과 제강 분야에도 쓰임이 많다.

Ovako heeft samen met Linde Gas AB een grootschalige proef uitgevoerd om staal te verwarmen met waterstof alvorens te rollen. De proef is met goed resultaat uitgevoerd in één van de ovens in de walserij Hofors in Zweden.

De l'hydrogène utilisé à la place du gaz naturel pour la production commerciale de l'acier, une première !

Mines & Energies 25 jours 0

En Suède, le sidérurgiste Ovako et le producteur d'hydrogène Linde Gas ont utilisé de l'hydrogène au lieu du gaz naturel comme source de chaleur à haute température dans le cadre d'un projet pilote pour produire de l'acier. Une première mondiale.

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Examples of industry applications – current cases with Linde involvement

Using clean hydrogen to reduce carbon footprint

Steel production

Clean hydrogen can be used to replace fossil fuel during the steel production process. Successful first-ever full-scale test with Ovako in 2020.

Rail transport

World's 1st stationary HRS for fuel cell trains. Up to 1,600 kg H2 per day. On-site storage of up to 1800 kg GH2. Hydrogen supply through Linde GH2 trailers
Commissioning in 2021.

Marine transports

Green light for the worlds first hydrogen fueled ferry boat. The Norled ferry will traffic Stavanger, Norway in 2021. Capacity of 299 passengers and 80 cars.
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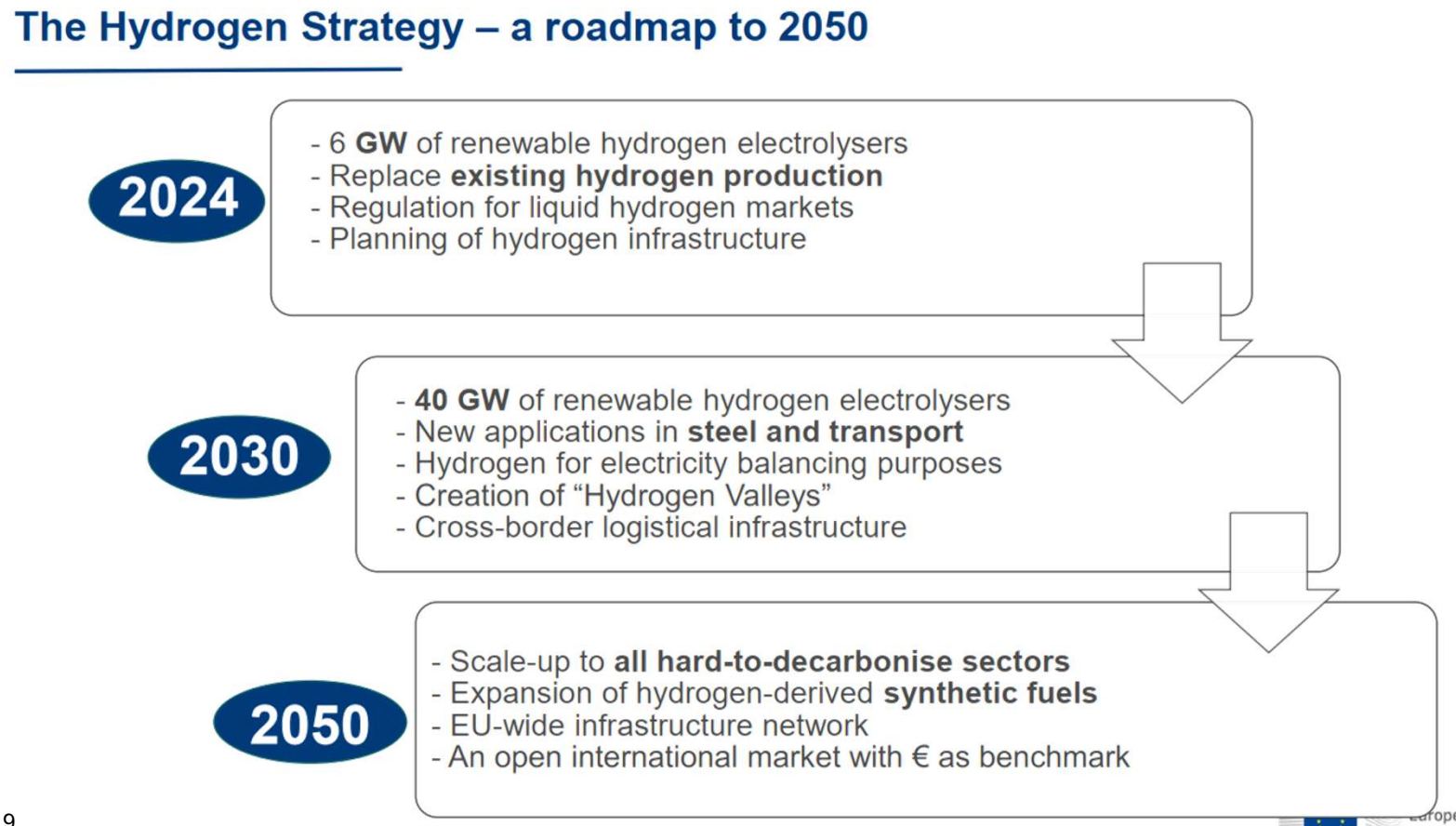
HYDROSPIDER

Heavy vehicle transports

Fuel cell technology key to achieve CO2-neutral transport. Linde holds 10% share in Swiss Hydrospider project. Close cooperation with Hyundai Hydrogen Mobility (HHM) to establish H2 HGV fleet in CH.

We can move considerably faster than EU roadmap



European Commission

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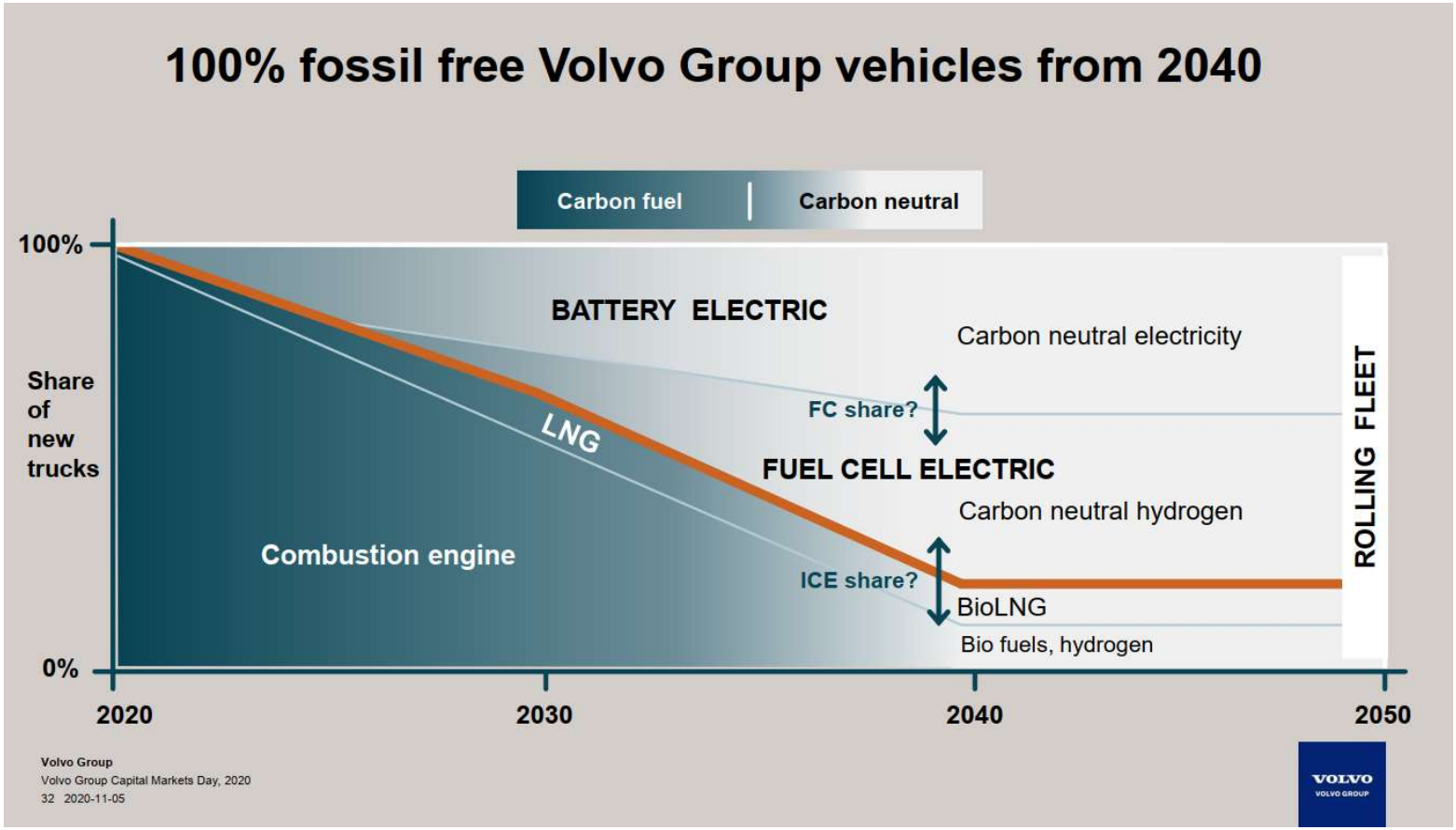
Early pilots for fuel cells is a central matter for the heavy vehicles industry



A clear possibility – with the right financing

- Finland/Sweden could be the first in the world with this new technology, which then in all likelihood will be used across the world
  - Ovako is willing to share knowledge and experience

- The project should have the best economy among all hydrogen projects today
  - Infrastructure in place
  - Oxygen usage in place
  - No storage needed for hydrogen
  - Heat can be recovered for municipal heating system
  - Electricity flexibility comes with a distinctive value
  - Hydrogen fuel station subsidized by the oxygen usage and infrastructure

→ The payback lies in gains for society at large, not within Ovako

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Thank you!