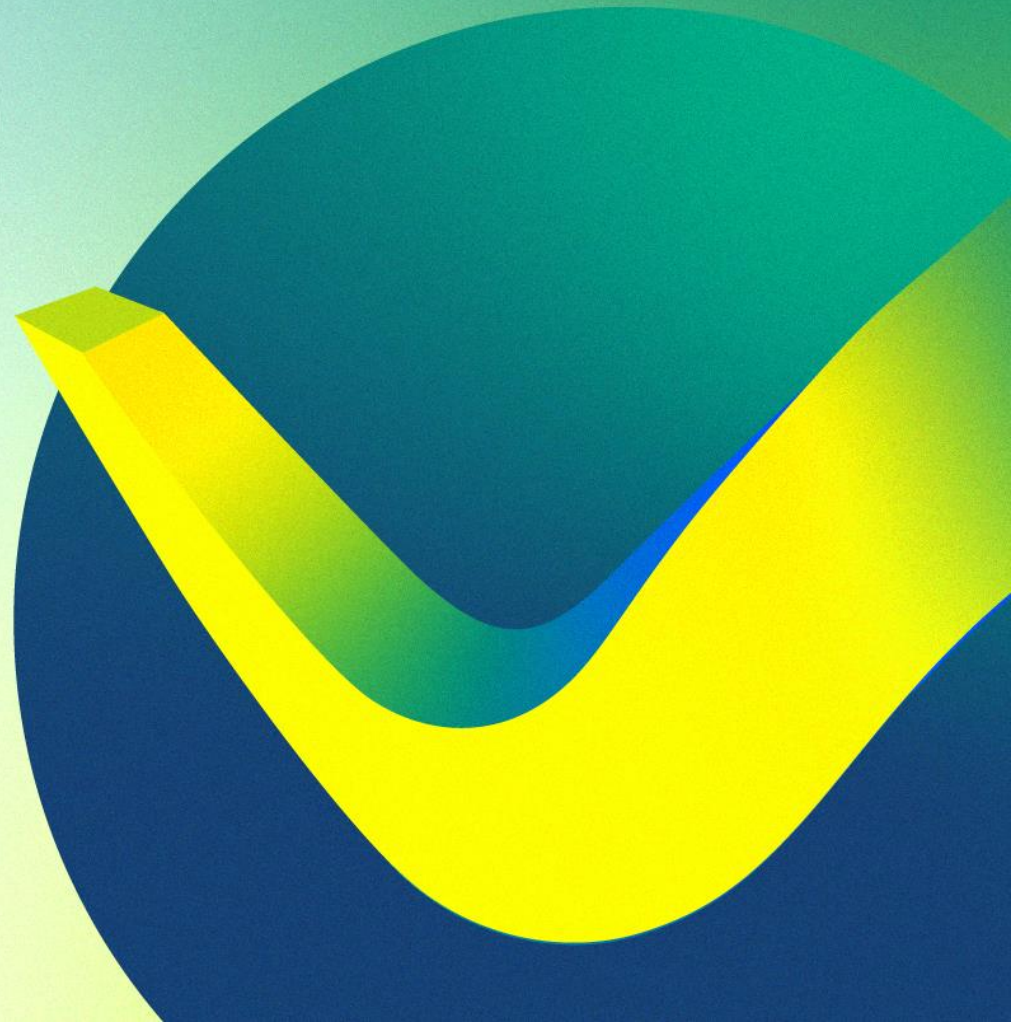
How H_2 is changing the energy equation in Europe?

Madhu Sayeenathan

Segments & Applications Manager

SSAB Europe



Content

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- Why do we need Hydrogen?
- How much of Hydrogen is produced & where is it used? – Existing & future
- Why can’t we use Green Hydrogen to decarbonize in every industry?
- What is SSAB’s role in Hydrogen?
- Key takeaways

Hydrogen: Fuel of the universe

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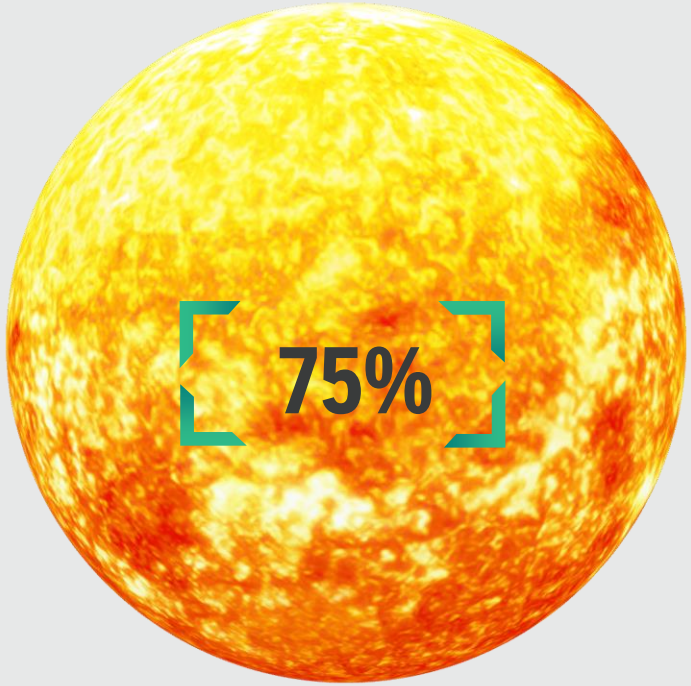
Hydrogen content in the universe and sun, **% share**



Hydrogen is the most abundant element in the Universe

Source: Wikipedia

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WHY DO WE NEED H_2?

Why hydrogen?

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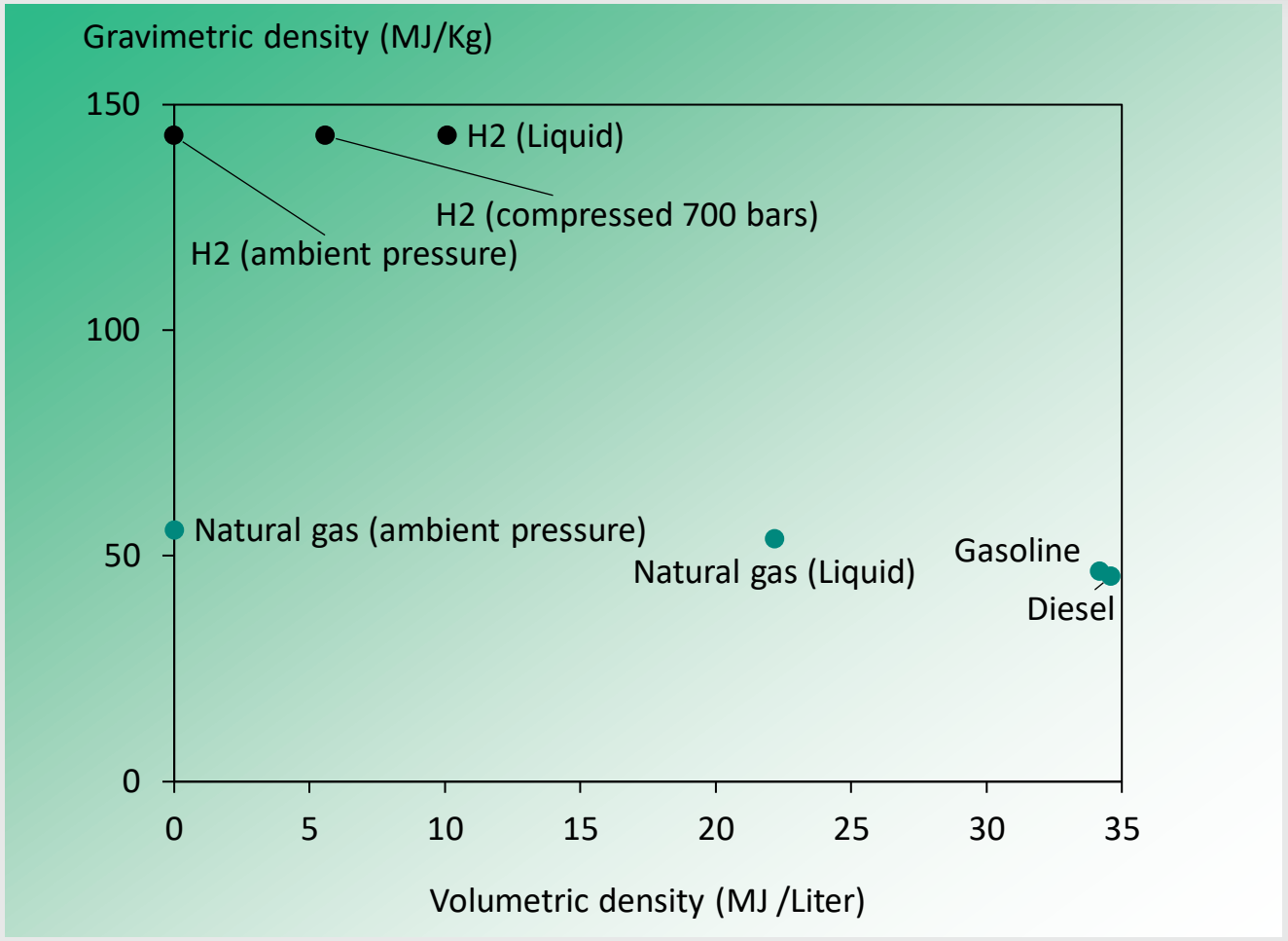
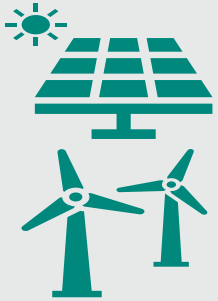


Source: Hydrogen as an energy carrier: Prospects and challenges, Renewable and Sustainable Energy Reviews

Why hydrogen?

	Extraction/ production	Combustion
Fossil fuel			
Green H_2			

Water

Why hydrogen?

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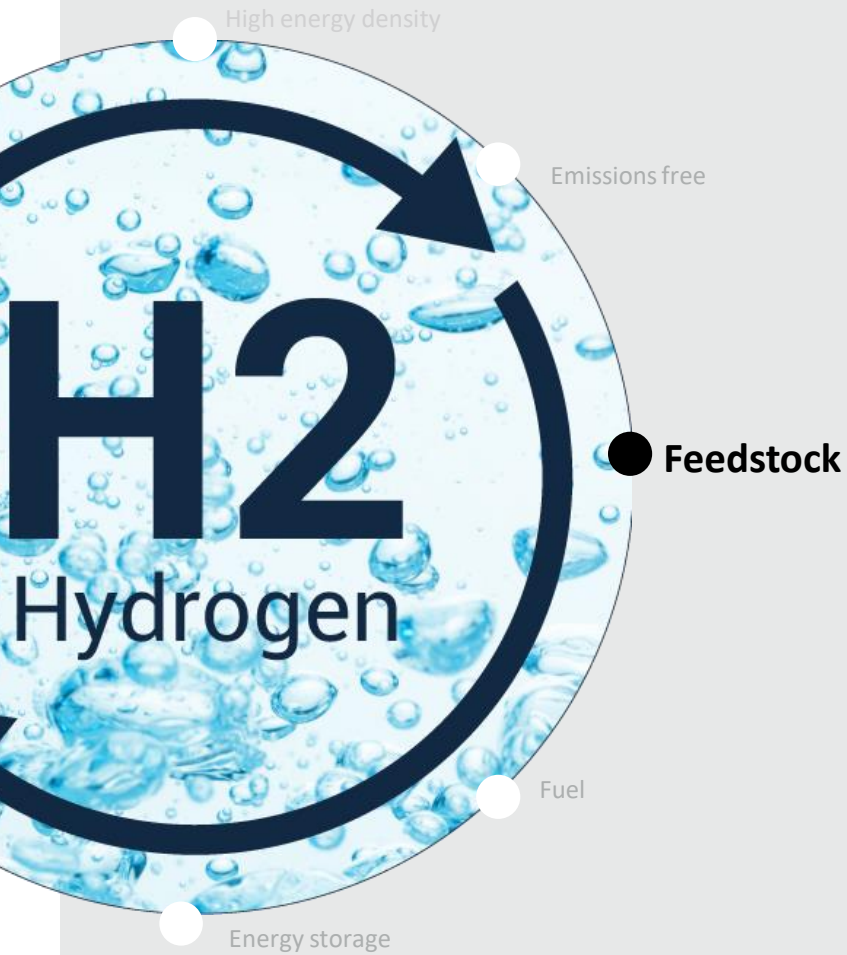

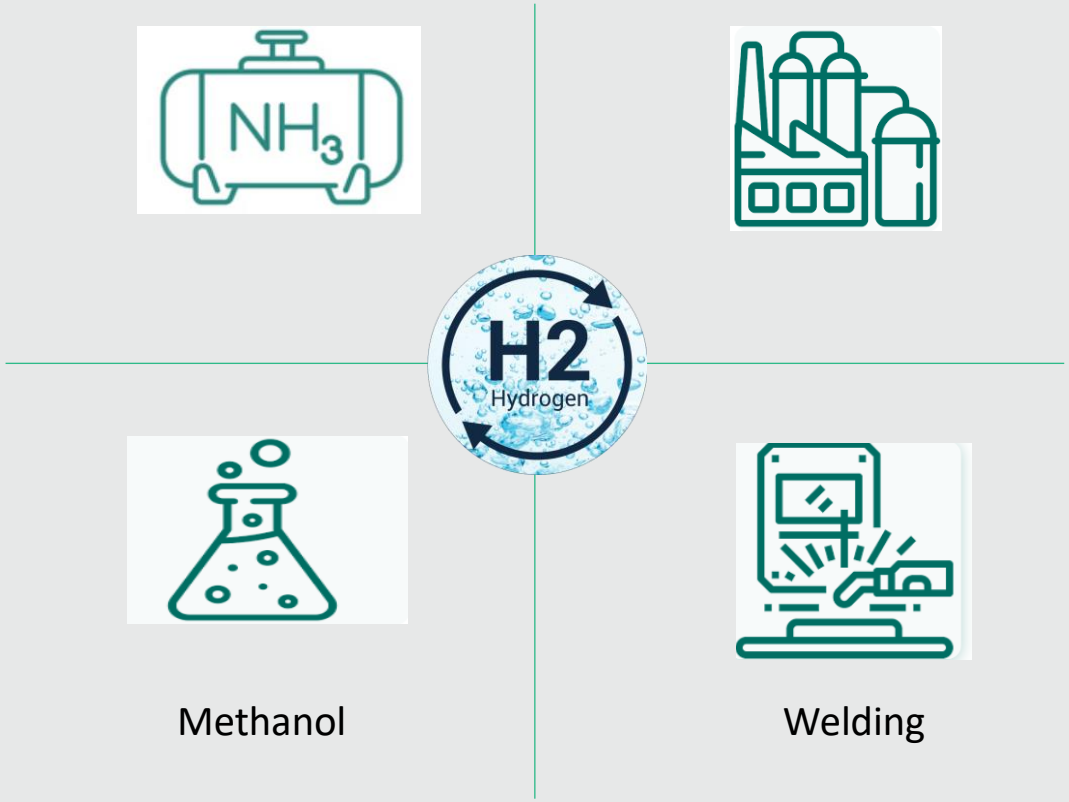

Why hydrogen?

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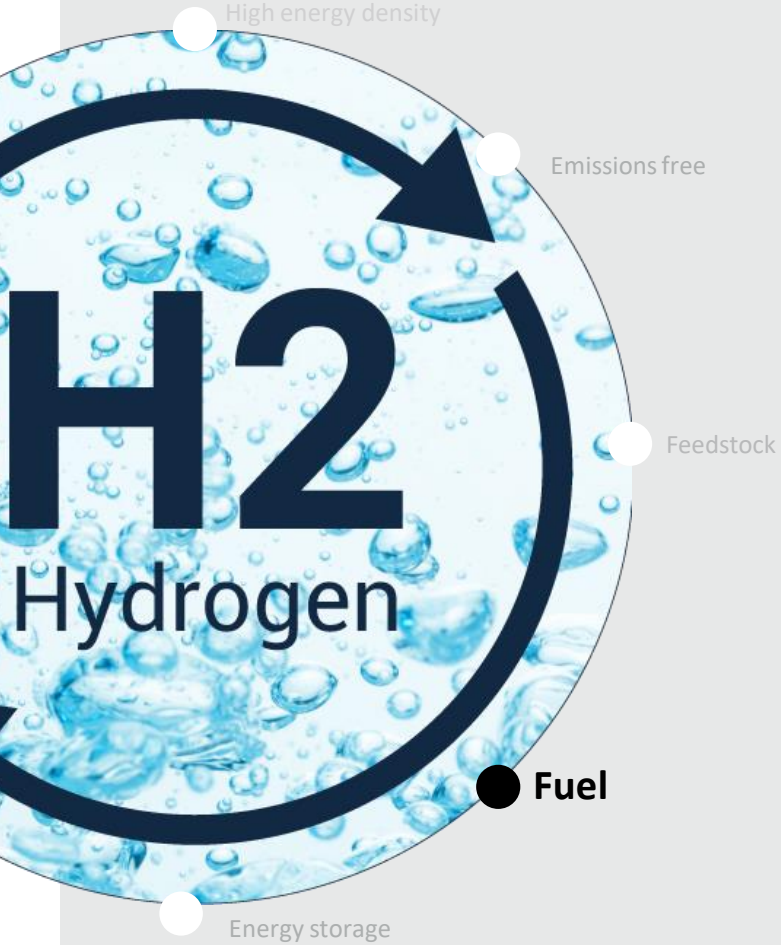

H_2 powered fuel cell electric transport

Why hydrogen?

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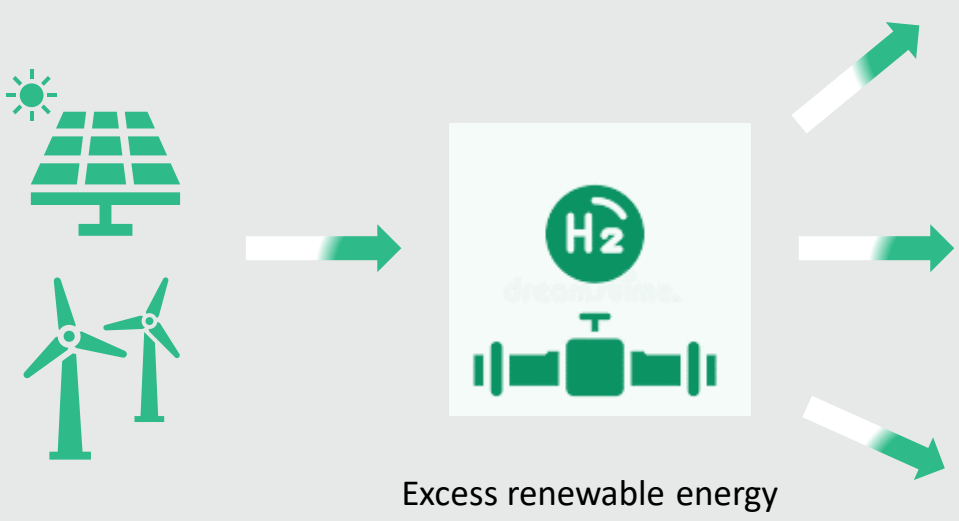
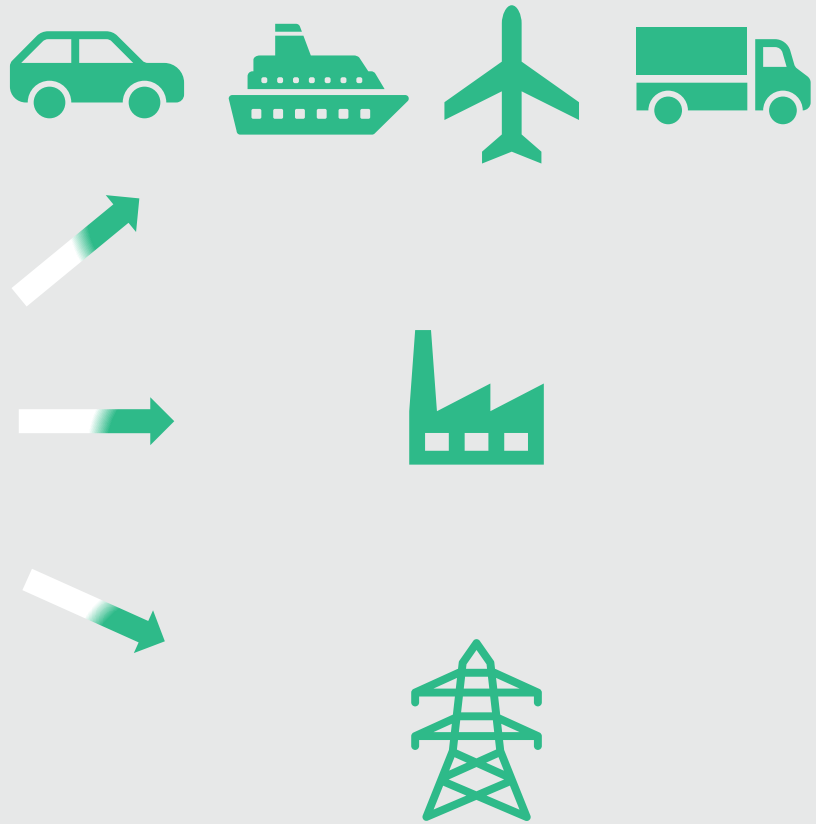


Excess renewable energy



Connected back to grid when in need

H_2 with its versatility, has the potential to abate up up 16%* of all European Co_2-eq. emissions

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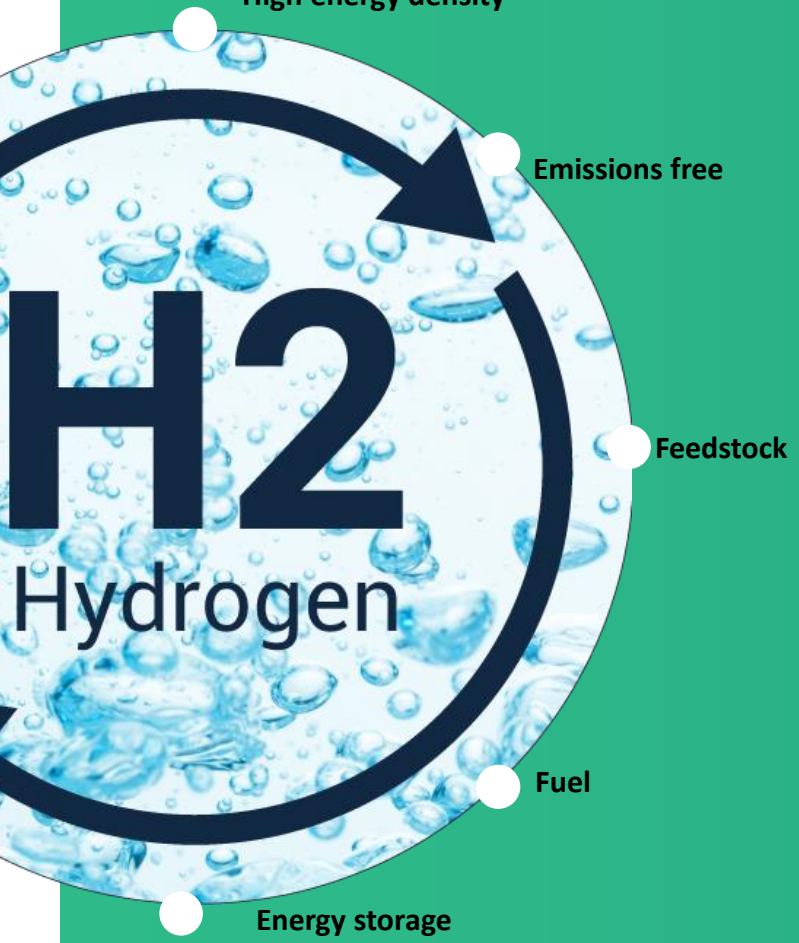

Source: *Clean Hydrogen partnership

HOW MUCH OF H_2 IS PRODUCED?

WHERE IS H_2 USED?

EXISTING & FUTURE

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Today, 90% of the produced H_2 is used in the chemical industry as feedstock

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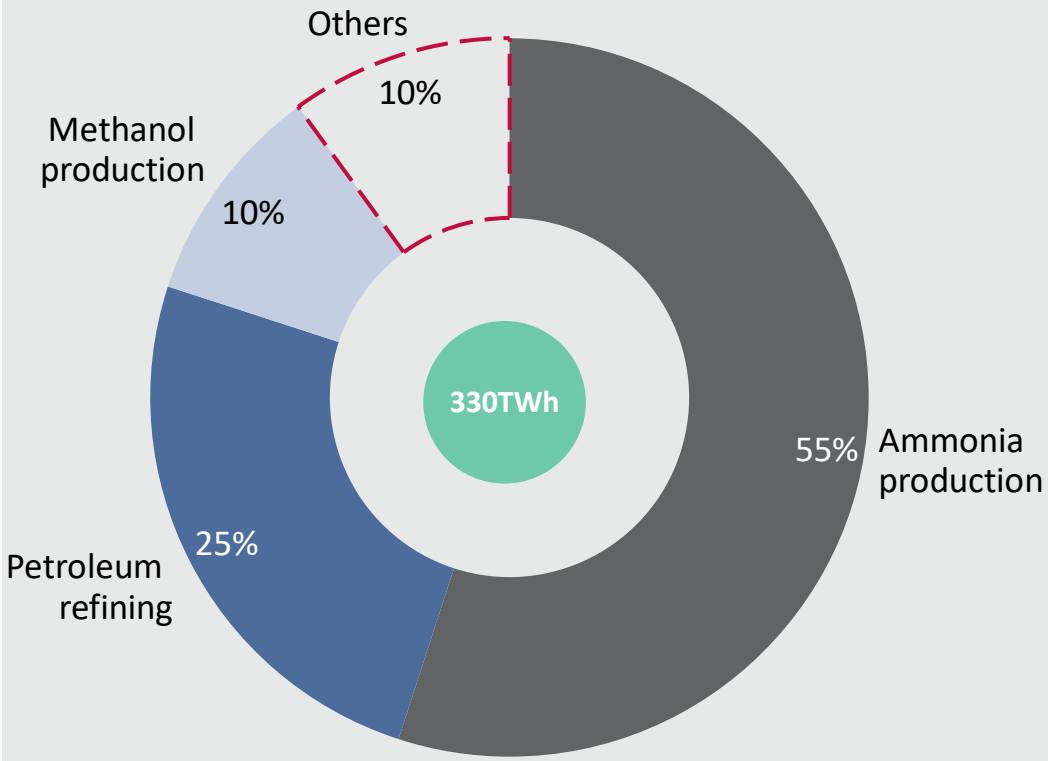
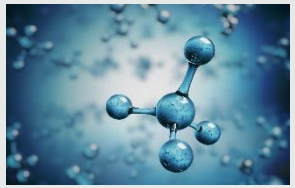
Hydrogen key utilization today Globally, **Twh, % share**



Ammonia

Petroleum refining



Methanol

Other applications- Steel annealing, welding, glass production, rocket fuel

Source: Clean H2 monitor

By 2050, H_2 demand is forecast to grow exponentially, driven by the Global decarbonization

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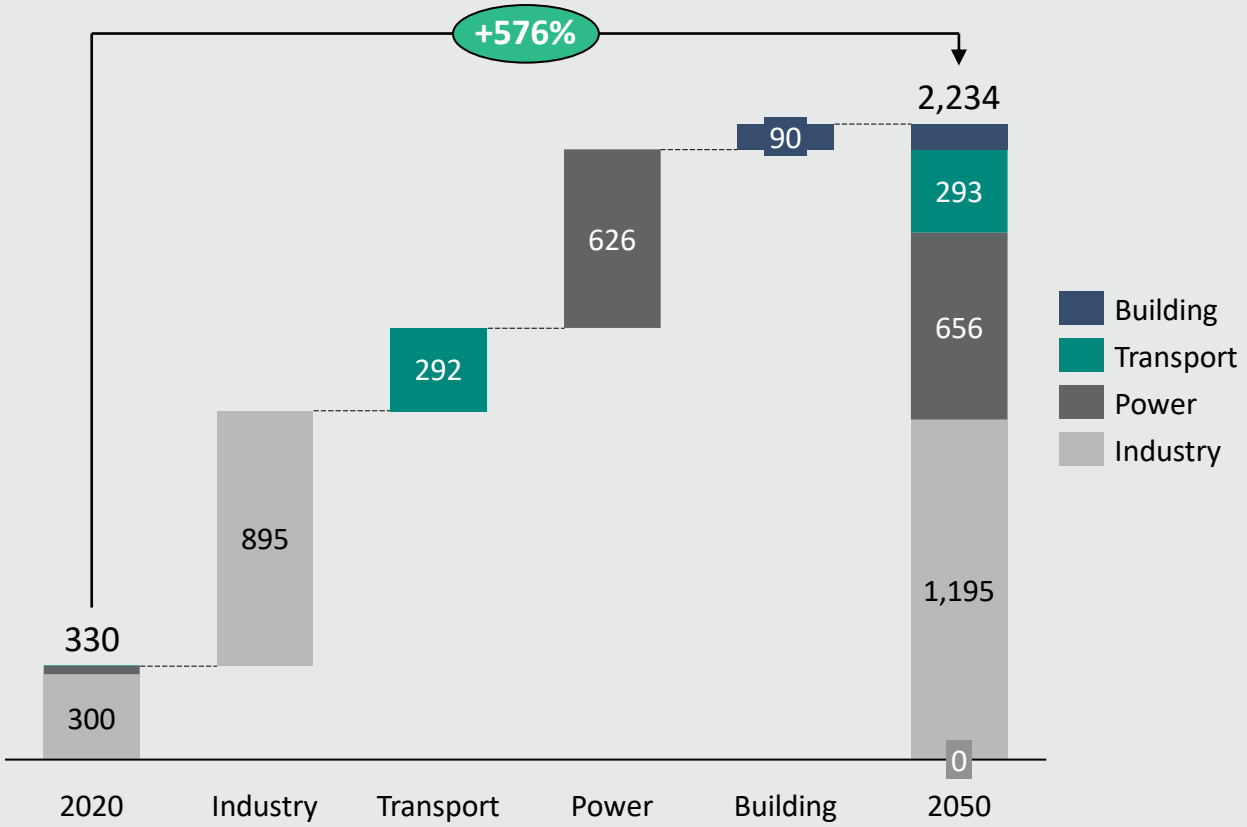
2020-2050 vision: Hydrogen growth forecast by sector and key drivers, **Twh**



Source: Clean H2 monitor

Almost all H_2 produced today is fossil based; By 2050 it is expected to change to Green & Blue H_2

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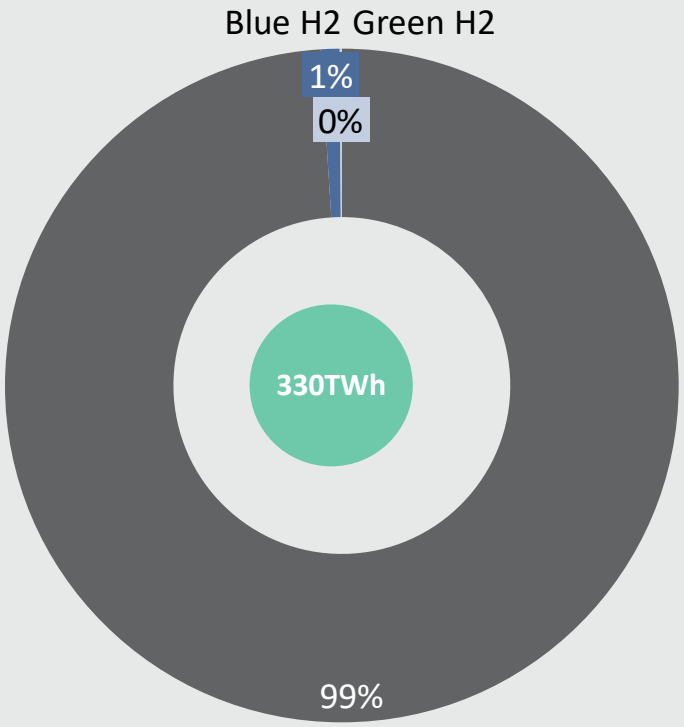
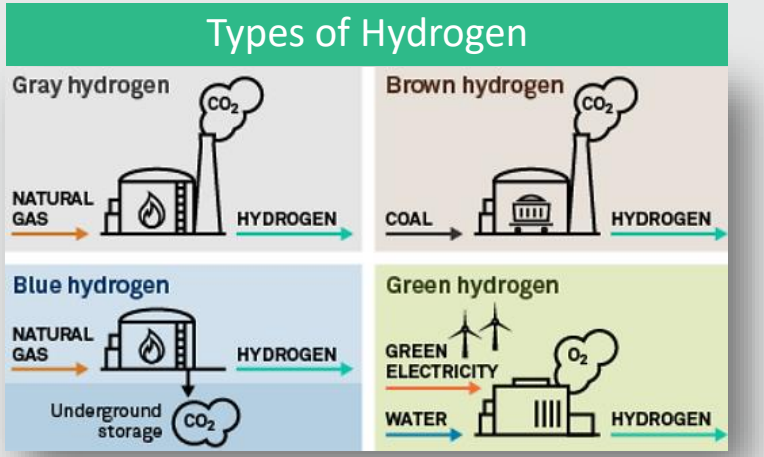
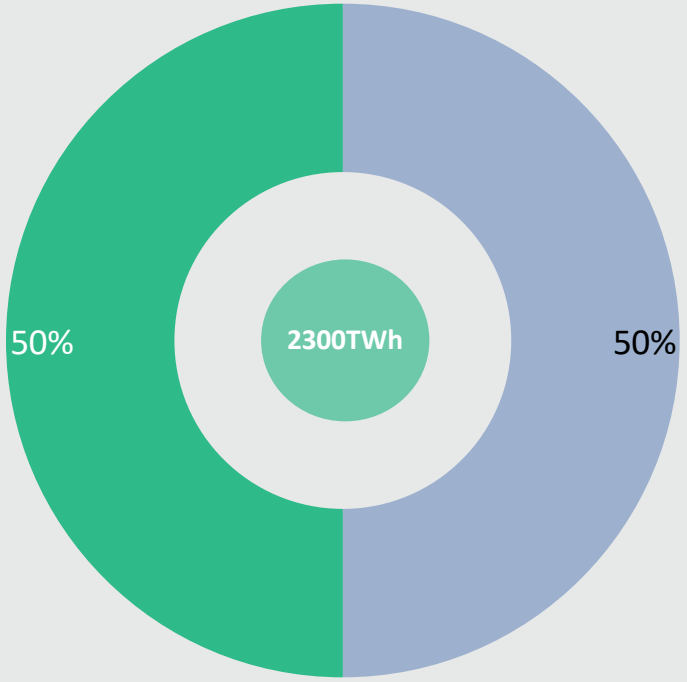
Hydrogen key utilization today Globally, **Twh, % share**

2020





2050



Grey H2 Blue H2 Green H2

Source: Clean H2 monitor

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WHY CAN'T WE USE GREEN H_2 TO DECARBONIZE EVERY INDUSTRY?

To meet EU's H_2 goals by 2030, almost all yearly addition in solar PV or wind should be directed to H_2

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Green energy needs to achieve EU H_2 goals by 2030, **GW, %**

10 Mill tons H_2 = 550 "Green" Twh

14% of EU's electricity consumption

50% of EU's renewable electricity demand

H2 Hydrogen

430 GW of solar PV or
220 GW of onshore

41 GW of Solar &
19 GW of wind power

Source: IEA, SSAB's analysis

Green H_2 is projected to become competitive by 2035 thanks to rising CO_2 cost & subsidies

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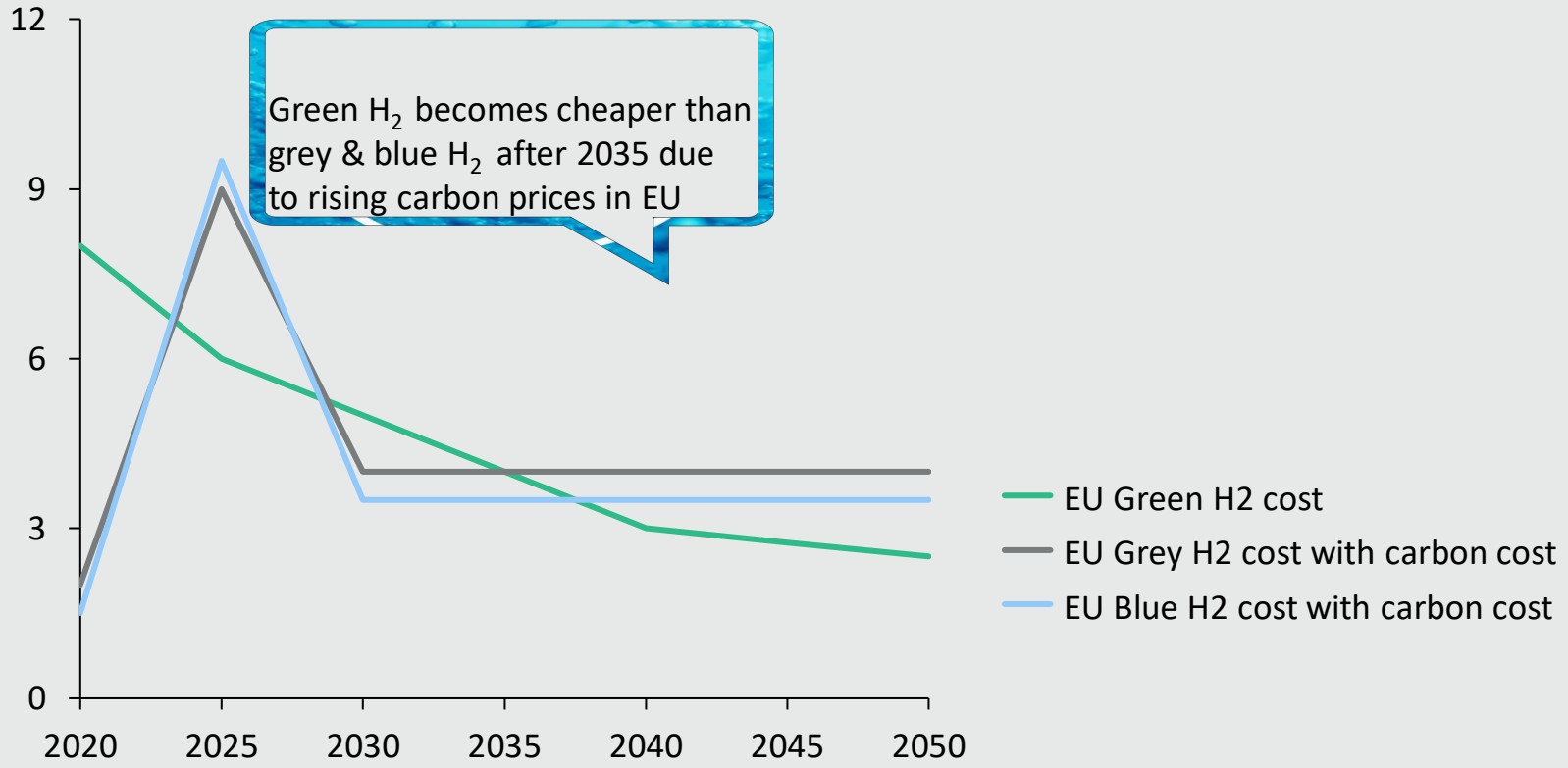
2020-2050: Global and European H_2 cost projection, **$/kg**



Source: CRU, SSAB's analysis

Given the availability limitations of renewable energy, prioritization will be required for H_2

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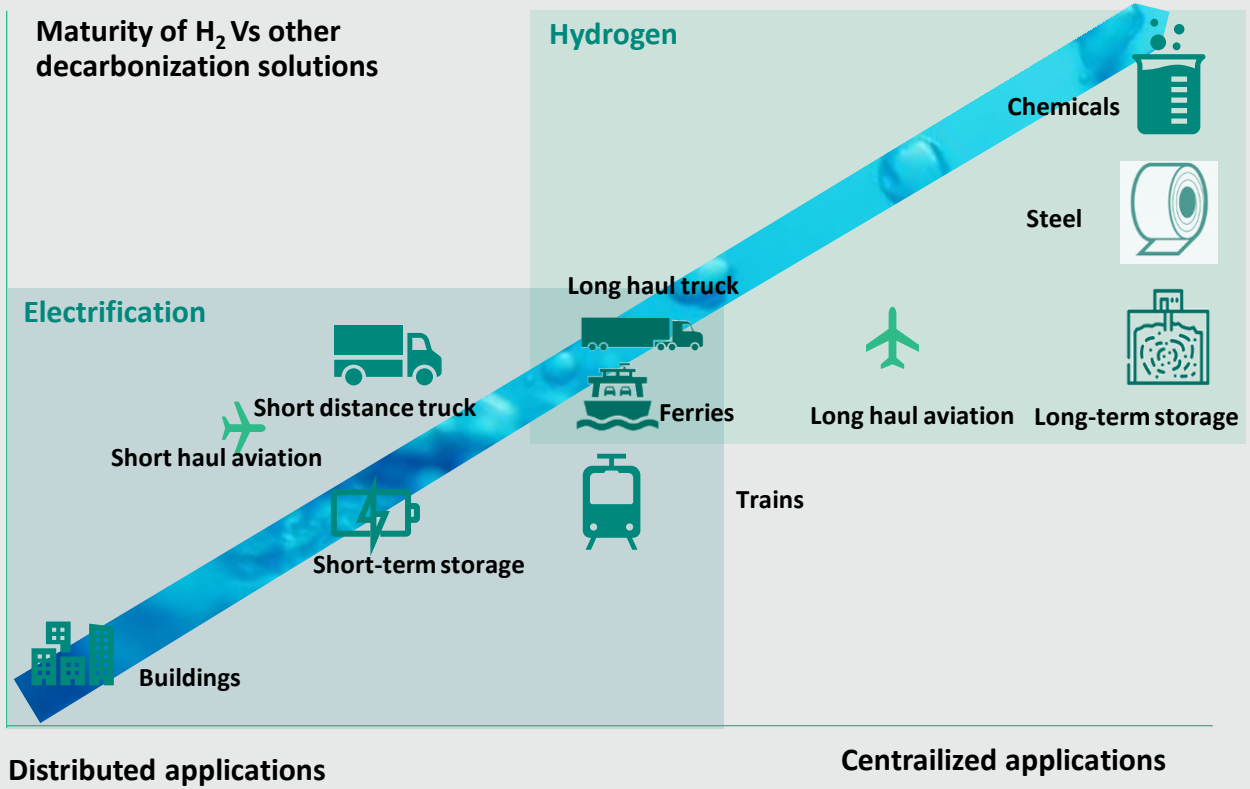
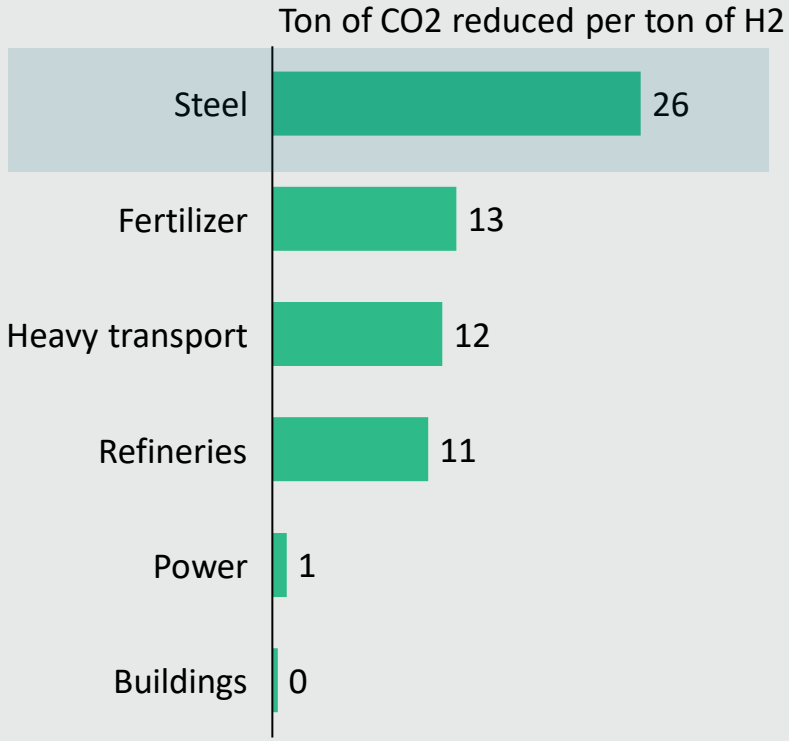
Hydrogen potential to reduce tons of **Co_2** per Industry/ Application, **tons of Co_2 per ton of H_2**





Source: ARENA, European H2 backbone

Key Hydrogen transition challenges

Investments

Policies & subsidies

Standards & safety

H_2 steel interaction

Source: H2data.de, IEA

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WHAT IS SSAB'S ROLE IN H_2?

H_2 & steel are interdependent but H_2 embrittlement poses a challenge

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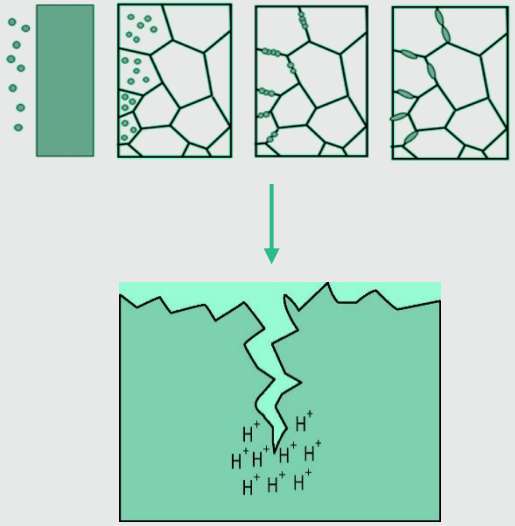
Hydrogen value chain as a reducing agent and final product

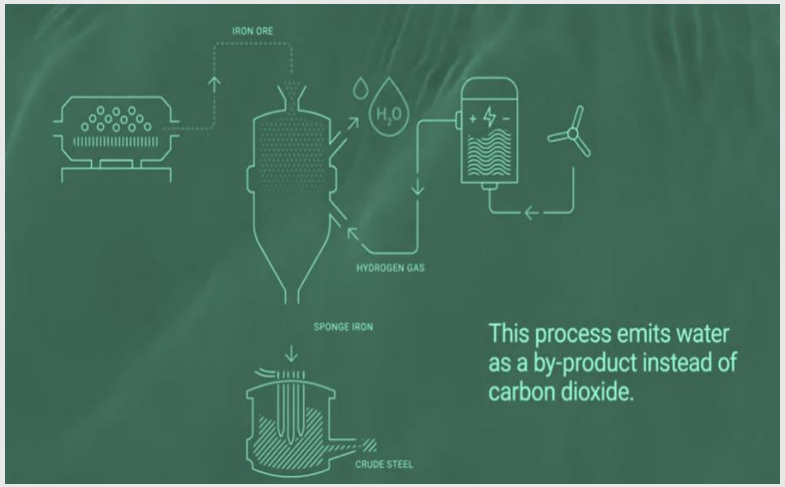
1 Steel is an integral part of entire H_2 value chain

- **~ 1 Mill tons/ year of steel till 2050 in Europe**
- **Renewable energy needs steel**

2 H_2 embrittlement !



3 H_2 is key to decarbonize steel industry



Source: SSAB's Analysis

Making steel & H_2 meet – SSAB's role

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Existing & future products for H_2 infrastructure

1 Pipelines

Tubular products

2 Cylinders

Hardenable steel

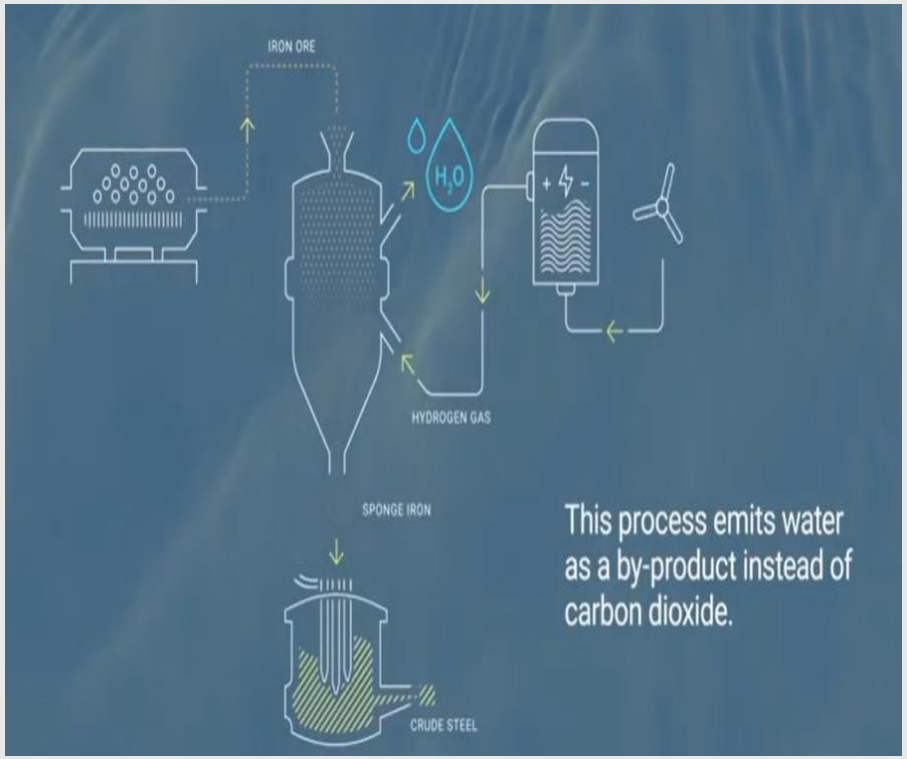
$34CrMo_4$

3 Storage tank

HIC* tested

Pressure vessel steel

HYBRIT -Fossil free steel using H_2



Source: * Hydrogen Induced Cracking, SSAB's Analysis

With two sustainable offering, SSAB can support H_2 infrastructure to be even more greener

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The next generation of recycled steel

SSAB Zero™ is made from recycled steel and produced with fossil-free electricity and biogas- resulting in steel with virually no fosisil carbon emissions

The future is fossil-free

SSAB Fossil-free™ steel is produced by using HYBRIT Technology, with direct reduction of iron ore using fossil-free hydrogen emitting water instead of Co_2

Green hydrogen…

- Is versatile & key for meeting climate goals
- Production is highly energy intensive
- Is to be prioritized in industries where direct electrification is not possible
- Steel & H_2 are interdependent, but embrittlement gets in the way
- SSAB with fossil free steel & SSAB Zero could make H2 infrastructure greener

Thank you!

Madhusoodhanan Sayeenathan (Madhu)

E-mail:madhusoodhanan.sayeenathan@ssab.com

Phone : +358-(0)50-314 2970

Candle holder *A piece of the future*
Ø 150 mm. Design: Lena Bergström.

SSAB