Perspectives on hydrogen use

in the steel industry

April 15th, 2021 | Gerrit Riemer| Head of Governmental Affairs Germany/Head of Hydrogen Economy| thyssenkrupp Steel Europe AG



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EAS

We have defined clear climate goals

-30% Emissions from our own production operations and processes¹

2030 -30% Emissions from energy procurement²

2050 KLIMANEUTRAL CLIMATE NEUTRAL

1) SCOPE 1-Emissions; 2) SCOPE 2-Emissions (Base year 2018)



Hydrogen for

climate-neutral steel

2024 onwards The milestone

Using a large-scale direct reduction plant (DR) which will be operated using green H₂ in the future, thyssenkrupp will produce sponge iron which will then be processed in the blast furnaces (BF), allowing a further reduction in emissions.

2026 onwards

The melting unit

We will optimize the hot metal

system using a new, electrically powered melting unit. The sponge iron from the DR plant is thus liquefied for the BOF meltshop. In

this way, we will replace the first

Avoiding CO 2 (Hydrogen path)

Using COLCabon2Chem®1

coal-based blast furnace.

2019 - 2022 H2 in the blast furnace

We have been testing the use of hydrogen in a working blast furnace since 2019. The goal: The equipment of blast furnace 9.

2030 onwards The scale-up

We will replace another coal-based blast furnace using a second, larger DR plant and another melting unit.

2050 onwards **Climate-neutrality**

We will produce our steel climate-neutrally in four DR plants and four melting units.

Further process

2018

The world first

2020 onwards Industrialization

The pilot system at the Duisburg steel plant uses steel mill gases to produce base chemicals.

2025 onwards Large-scale production

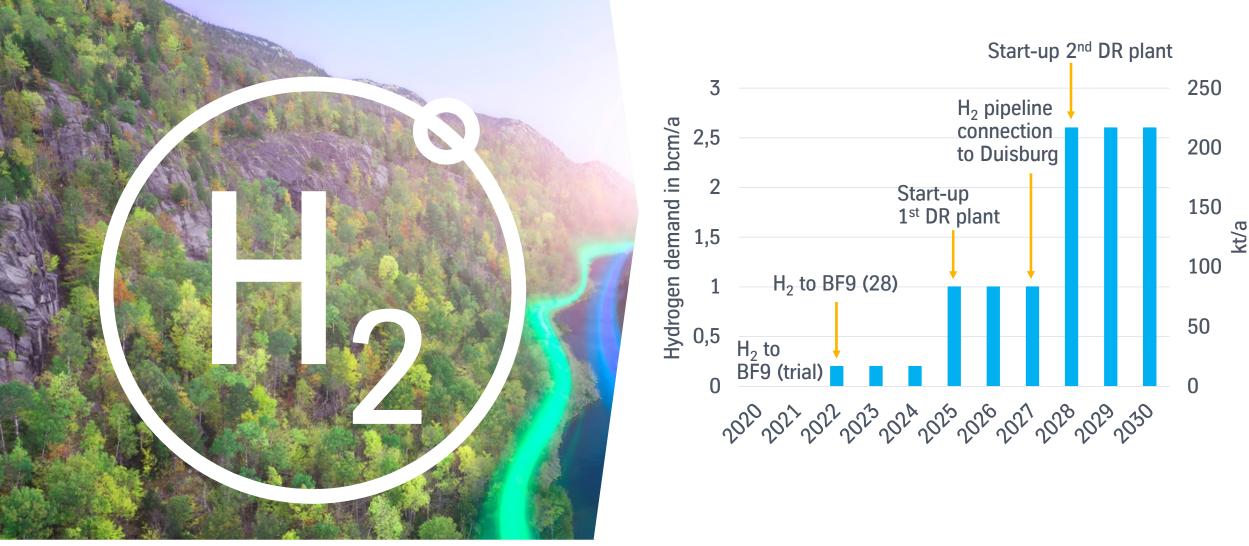
-20

million t CO

We will use the unavoidable CO₂ as a raw material on an industrial scale. The Carbon2Chem[®] technology can also be used in other sectors, like the cement industry.

The concept: CO₂ becomes raw materials. In September 2018, thyssenkrupp produced methanol from steel mill gases for the first time at its Carbon2Chem[®] technical center in Duisburg.

Our ramp-up will match availability of hydrogen and infrastructure

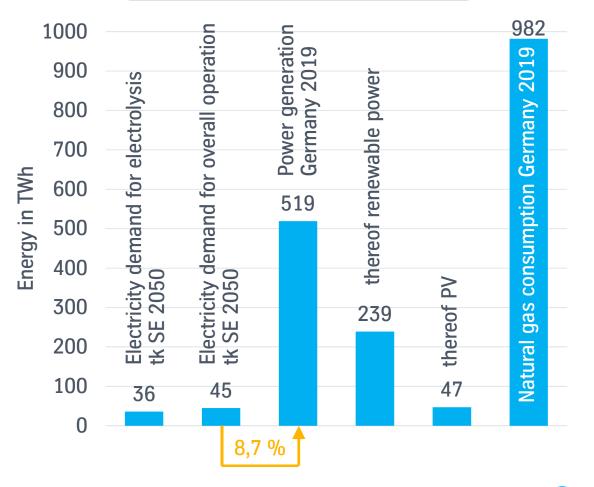




The energy demand is significant compared to the German electricity and gas market



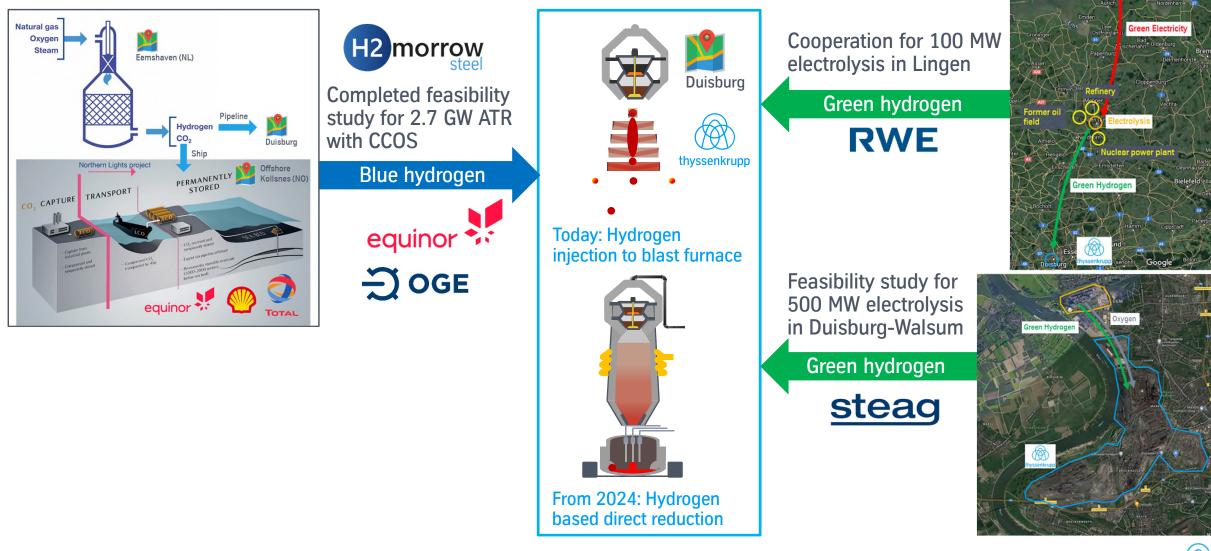
Assumption: 10 mtpa steel from hydrogen direct reduction, Carbon2Chem not included



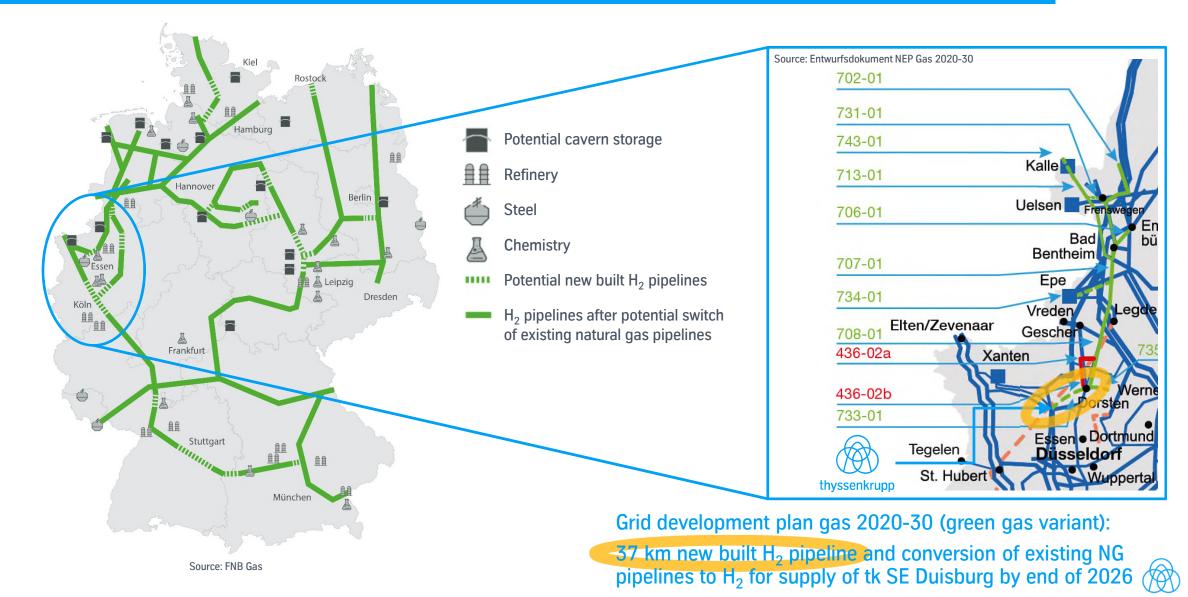
Sources: https://www.energy-charts.de/energy_pie_de.htm?year=2019

https://www.bdew.de/media/documents/Erdgasverbrauch_Vgl_2018_2019_monatlich_online_o_monatlich_Ki_12032020.pd

We follow an technology open approach in hydrogen supply projects



Hydrogen pipeline connection is a prerequiste for a succesful transformation ...



Conditions for the transformation must be created now

- Hydrogen Strategies of EU and Germany must be harmonised and quickly be transposed into a reliable legal framework.
- Hydrogen should be available primarily to sectors in which it is de facto indispensable for CO₂ reduction and has the greatest leverage on CO₂ reduction.
- Acceptance of natural gas and other climate-neutral hydrogen types for a transitional period until green hydrogen is reliably available in sufficient quantities and at competitive prices.
 Substantial expansion of renewable energies; uniform European system of guarantees of origin for clean and low carbon hydrogen
- Short-term adoption of long-term effective instruments to reduce operating costs such as Contracts for Differences and short-budget-independent financing
- Existing gas grids must be made available for H₂ transportation and be regulated as first step.
- Production conditions for steel in the EU and Germany must not deteriorate
- Creation of green "lead" markets with sector-specific mix of instruments (quotas, standards)



Thank you

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for your attention!

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