

SALCOS

Steelmaking. Reinvented.

SALCOS®

Sustainable Concept of Low CO₂ Steelmaking

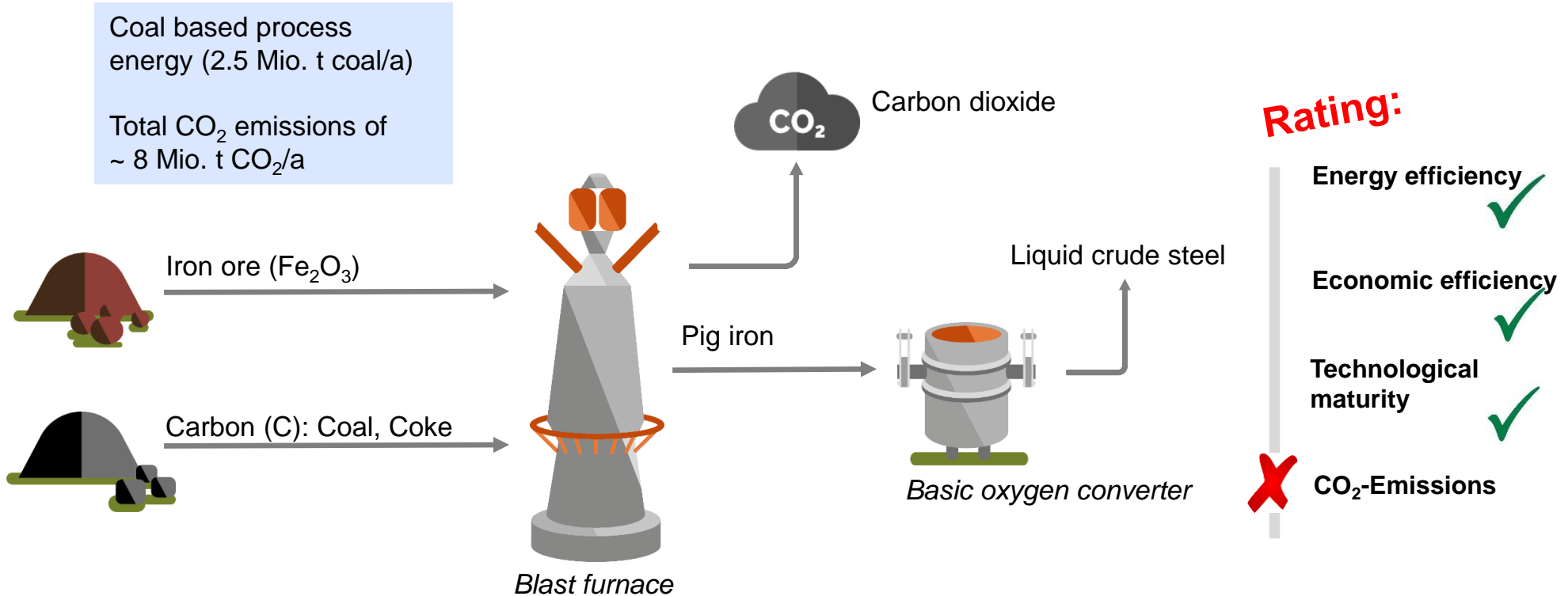
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How do we produce steel today?

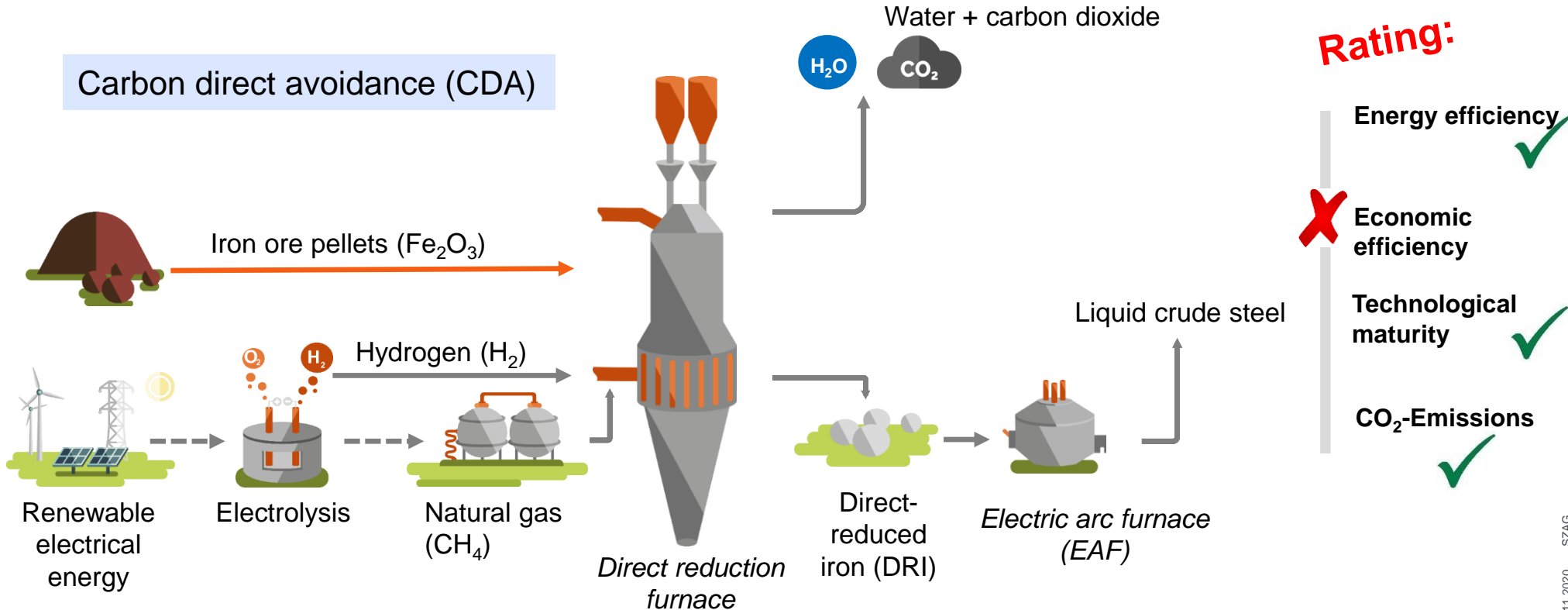
Blast furnace route = Carbon-based iron ore reduction + melting down



Steelmaking via the established blast furnace route is technologically optimized, very efficient and most economic ... but due to the process connected with CO₂-emissions of roughly 2 t CO₂/t steel.

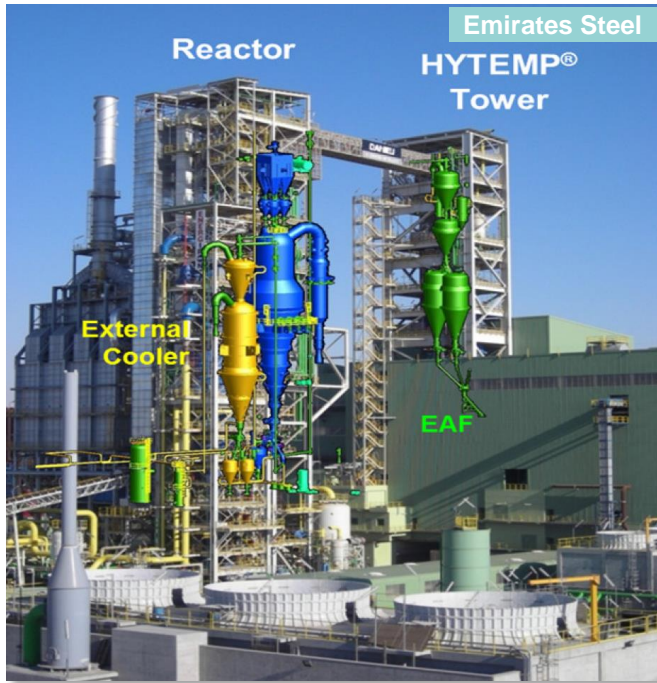
Novel, innovative SALCOS®-route
= H₂-based direct reduction + electrical melting

Carbon direct avoidance (CDA)



This process route has a high technological maturity ... and significantly lower CO₂-emissions. Even a process based on natural gas is able to reduce CO₂ by more than 50%. Hydrogen is the further/final improvement. However, the production costs are higher compared to the blast furnace route.

Two Examples of Operating, Natural Gas Based Direct Reduction Plants



Proven technology basis

World production from standard, natural gas (NG) operated shaft furnace DRPs in 2018:
~ 80 Mt Direct Reduced Iron (DRI)



Operated with NG (methane, CH₄):
Already high level of hydrogen content in process gas



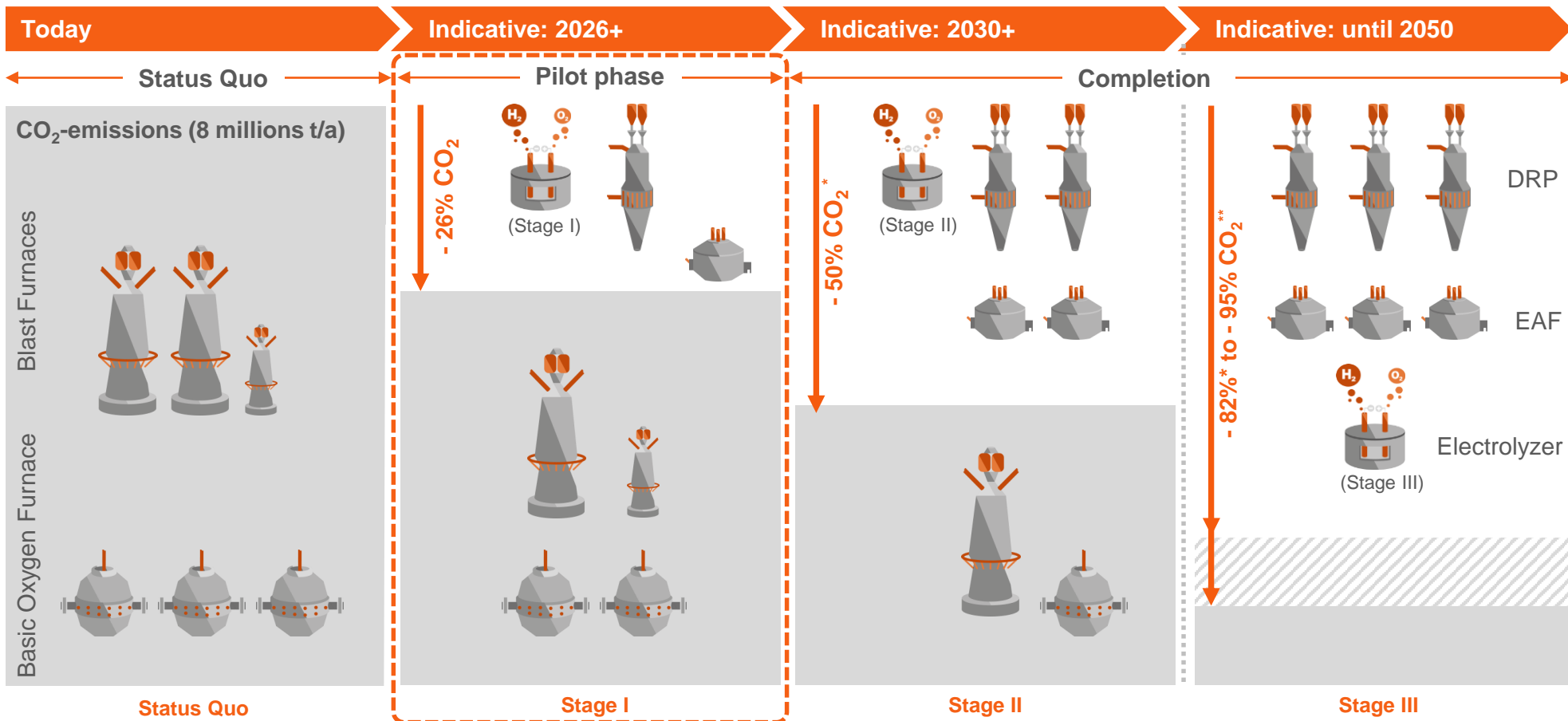
Lower CO₂ emissions compared to BF ironmaking right from the start (~570 kg_{CO2}/t_{DRI}, NG as single fuel, including downstream CO₂ emissions from C content of DRI)



Excellent starting point for
SALCOS development work



Transformation of integrated steelmaking in Salzgitter to H₂ enhanced DRP/EAF-based steelmaking in three stages

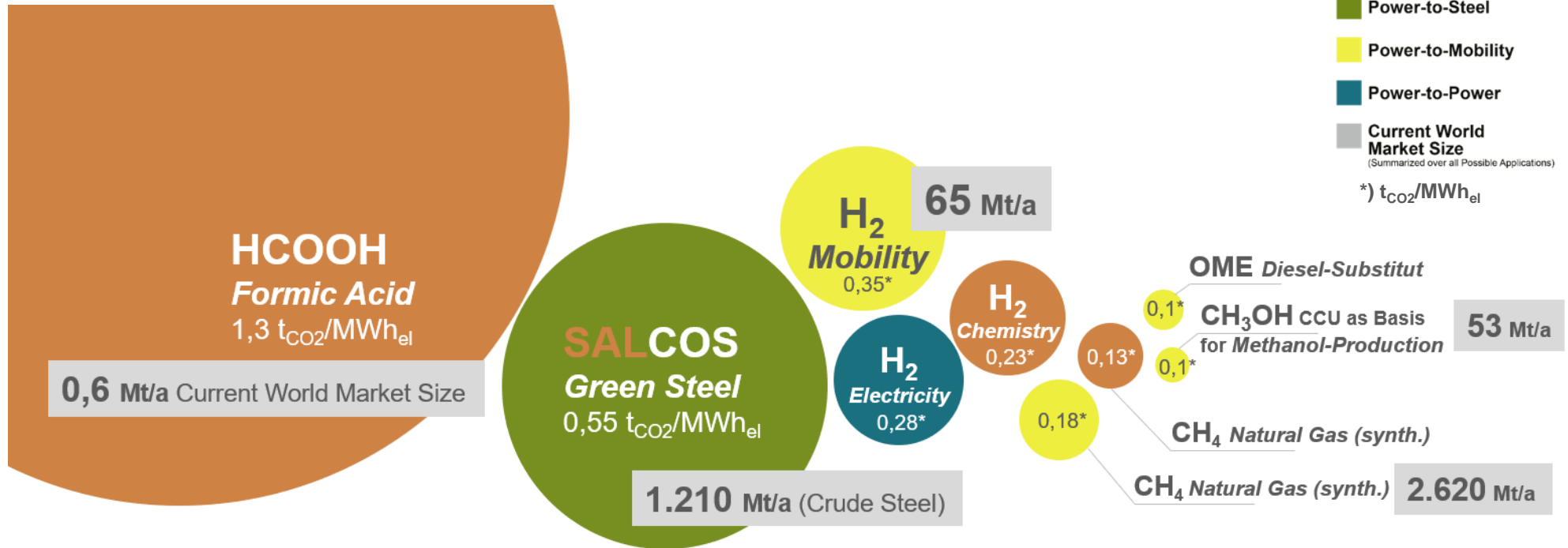


* with the use of 55% hydrogen / **with the use of 100% hydrogen

Individual stages may technically also be realized in combination – earlier or later – depending on the actual economic and political framework

„Merit Order“ – CO₂-Mitigation per Unit of Applied Electrical Energy for Industry Relevant Processes

The circle diameter indicates how much CO₂ per MWh_{el} can be avoided.
This means that the larger the circle, the more efficiently the technology avoids CO₂!



Summary

- The climate targets can only be reached by Carbon Direct Avoidance (CDA)!
- Due to the direct replacement of carbon by hydrogen the steel industry offers a very efficient opportunity to reduce CO₂-emissions even compared to other sectors.
- Our SALCOS-concept is based on industrially proven technology and can be realized short term, if the required political and economical framework conditions are available.
- We are aiming at an optimal sector-coupling of renewable energy, green hydrogen as well as low CO₂ steelmaking.
- Right from the beginning the direct reduction of iron ore based on natural gas is able to reduce the CO₂-output by more than 65%. After full transformation towards hydrogen the green steel will be nearly climate neutral (CO₂-reduction more than 95%).
- Our lighthouse project SALCOS could be a blueprint for a stepwise transformation of the European and World steel industry as a whole.
- We are ready and waiting for the appropriate political support!

Here, you see a huge difference...

 ...for the environment



Thank you very much for your attention!

**Up to 95 % less CO₂ in the steel production?
We are ready.**

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