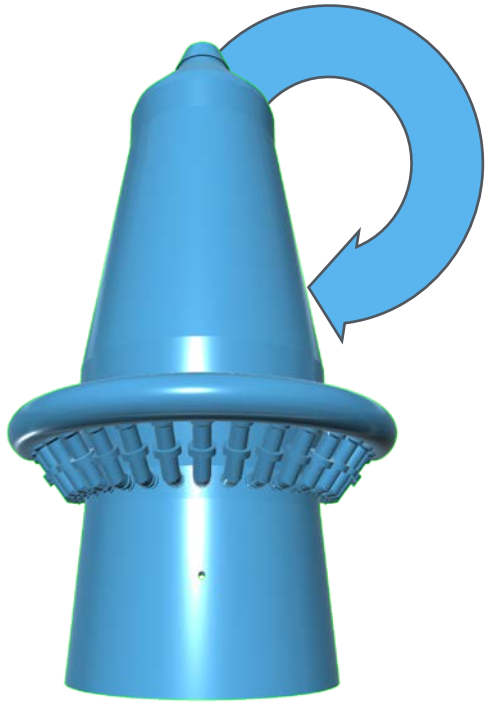
Operating the net-zero Blast furnace (OptBF)

Project concept



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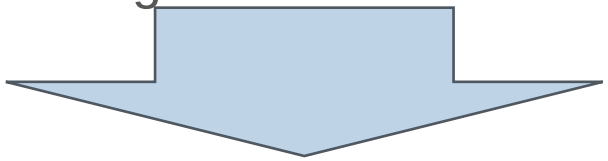
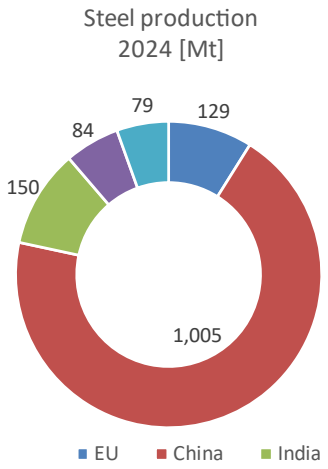
Current situation of the European steel Industry – Project starting point

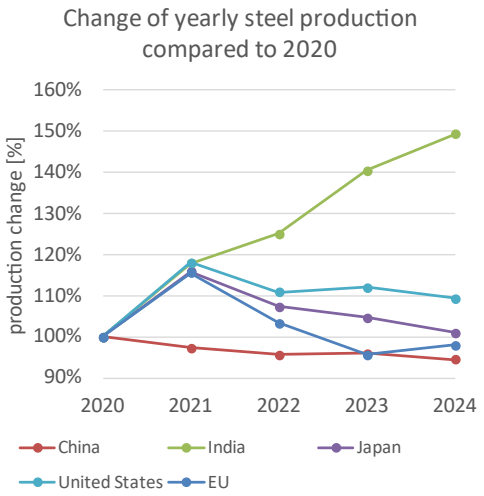
- The EU plans to reduce greenhouse gas emissions by 55% and to become climate neutral by 2050.
- Steel producers decarbonisation roadmaps foresee a decrease of BF-based ironmaking but still include the BF even beyond 2040.
- Natural gas or hydrogen for DRPs and renewable electricity for EAFs will not be available at competitive prices and sufficient quantities as assumed. Prices are strongly fluctuating.
- High grade pellets and scrap are not available at competitive prices and sufficient quantities for DRP-EAF-based ironmaking.

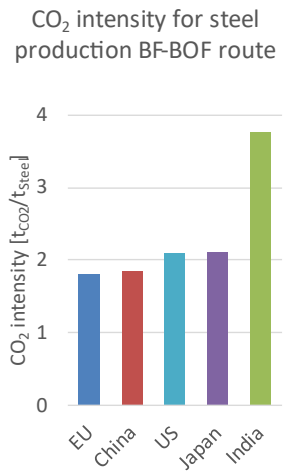


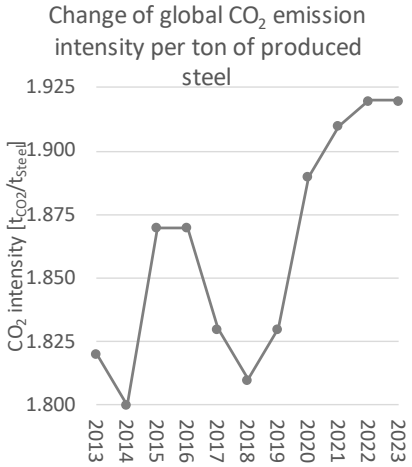
- Competitive and resilient steel production requires a parallel operation of BFs and new processes at least for the next decades.
- Options for low CO2 BF-based ironmaking are urgently required.

Global Status of CO_2 Intensity of steel production

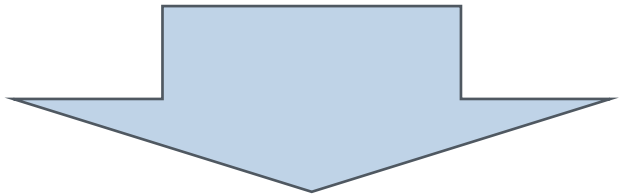








- 90% of primary steel is produced globally via BF-route.
- Steel production in the EU has the lowest CO_2 intensity but is decreasing since 2021. At the same time India increased steel production by 50% mainly through the BF route.
- Despite European efforts, global CO_2 intensity of steelmaking is increasing.



- The most efficient approach for the EU to support mid-term CO2 mitigation in global steel production is to demonstrate how BFs can be operated carbon lean in a competitive way.

State-of-the-art and recent developments

- Concepts for net-zero BF Ironmaking exist already since the ULCOS projects
  - Top gas recycling
  - Nitrogen free BF
  - Carbon sequestration and usage and storage (CCU/S)
  - Increase of hydrogen-based reduction share
  - Partial replacement of fossil carbon with renewable carbon

- Recent new developments
  - Knowledge about the influence of hydrogen on the BF process (e.g. low temperature burden disintegration)
  - Possibility to increase gas utilisation by new injection methods (e.g. sequence impulse injection)
  - Possibility to supply additional energy to the process by syngas / plasma torches
  - Newly available process options and technologies to make CCU/S more efficient (e.g. water gas shift reaction, generation of hydrogen from top gas)

Preliminary project outline

- The project shall examine new BF operation set points if operated under net-zero conditions:
  - E.g. demonstration of technological components (shaft gas injection, top gas treatment, …)
  - E.g. research on material behaviour under such process conditions (new standards, …)
  - E.g. systematic research to identify the most efficient work-points (simulation, …)
  - E.g. systematic research to combine measures to mitigate CO_2 towards zero