Right Technology pathways – some reflections

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Global Steel Production

Positive to see a broad spectra of solutions identified in Green Steel for Europe project as the resources in each country will influence the possible routes significantly

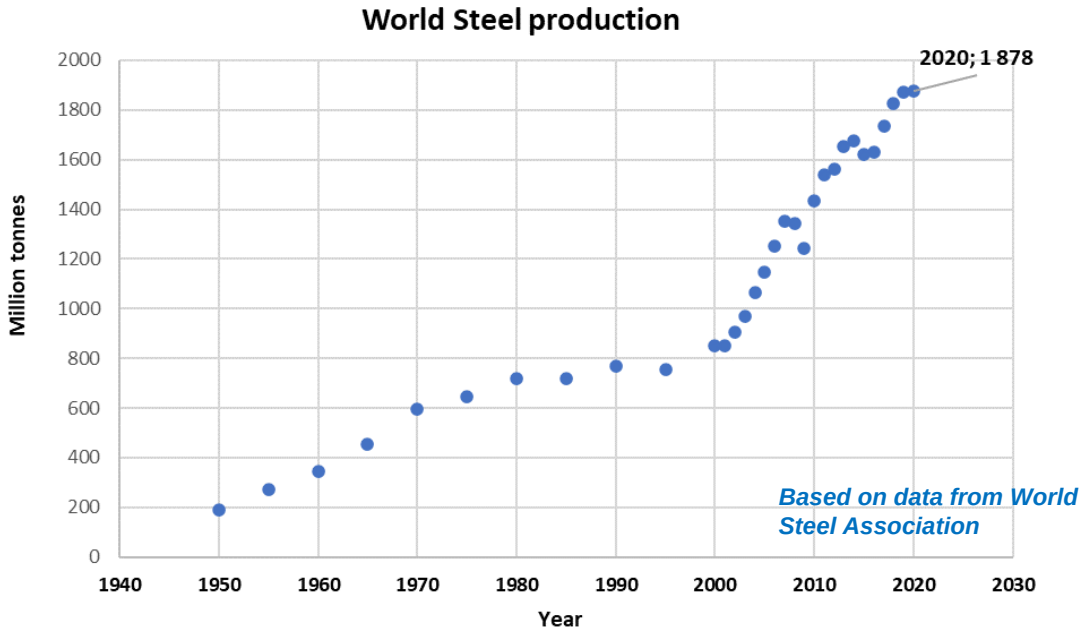
Increasing trend → need for primary steel production

Major part of primary Fe units for steel production are pig iron from BF

Latest increase, high production and use of steel e. g. in China and India

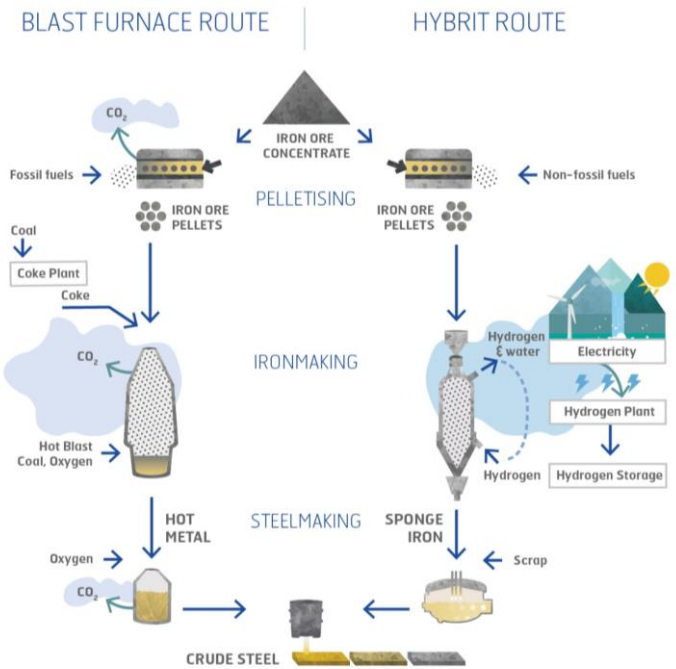
- BF/BOF route in China
- Approximately equally of BF/BOF and DRI/smelting in India (carbon based DRI)

Steel industry is responsible for roughly 7% of global CO_2 emission

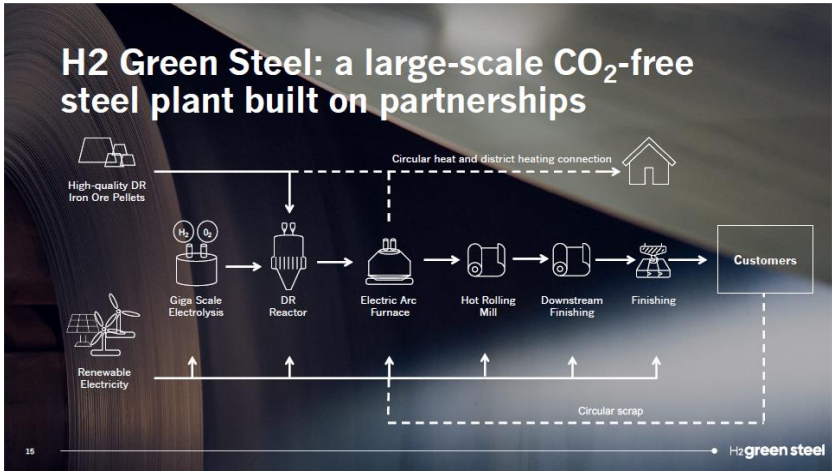


Positive if technologies developed in Europe can be exported to other parts of the world for decarbonizing the steel production

Various initiatives from all steel producers in Europe- examples from Sweden



Source: HYBRIT pressmaterial



Source: H2 Green Steel

Resources to consider

- ***Electricity for H_2 production***
- ***High quality iron ore***
- ***Scrap***

Varied technology pathways will minimize restrictions

Potential use of bio-related reducing agents

- **Bio-gases or liquid fuels** produce from e.g. black liqueur, lignin residue, food residue, agriculture products, forest residue, etc. CO_2 removal from bio-gas results in high methane content.

- **Solid products (charcoal, torrefied bio-coal)** from agriculture products, forest residue, waste wood, food residue, etc.

- **Feasible and high potential to lower the fossil CO_2 emission by using bio-coal** of various types is shown in theoretical evaluation as well as pilot/industrial tests.
  - **Bio-briquettes**
  - **Bio-coal injection**
  - **Bio-coke**

- **Existing infrastructure can be used**

Rough example of overall concept partly using bio-coal as reducing agent

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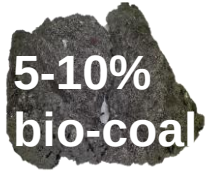
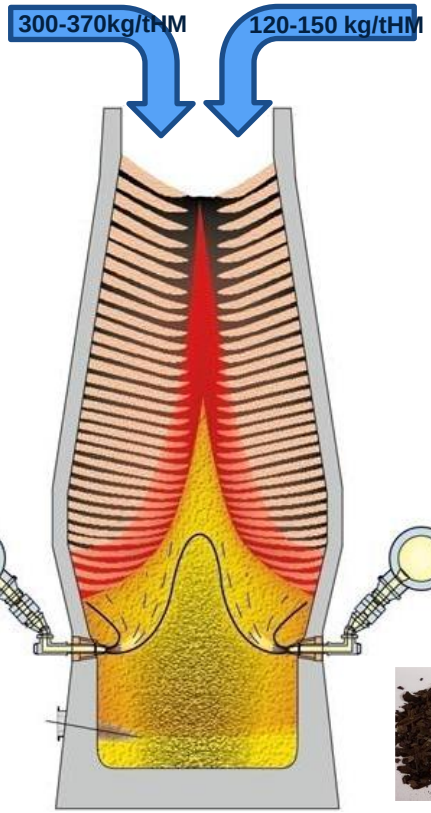
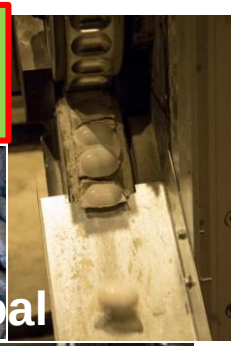
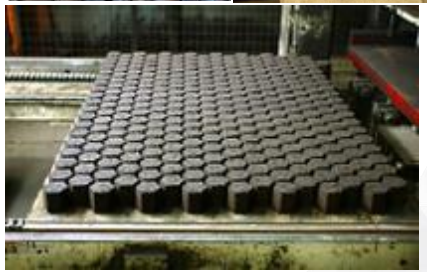
Bio-coke





Bio-agglomerates





Lowering of fossil CO_2 emissions due to use of bio-coals

- Δ%fossil CO_2 ~ - 20-40%

Including CCS with 95% capture efficiency more CO_2 than the fossil one is captured

Injection of bio-coal

140-175 kg/tHM

BF figure from M Geerdes, R Chanigneau, I Kurunov, O. Lingiardi, J. Ricketts Modern BF ironmaking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