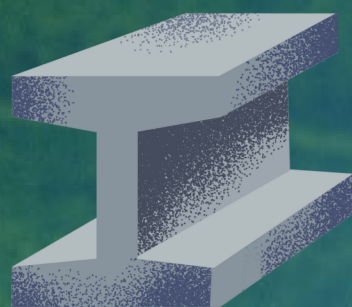


#H2OffThePress

The Green Steel case



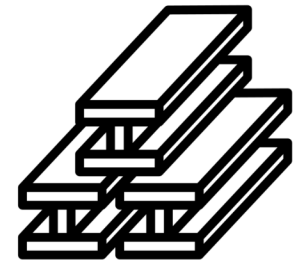
July 2023

*Discovering the potential of
Green Hydrogen in cleaning
up one of the
dirtiest sectors*



Yamna

Steel, the foundation for the world ...



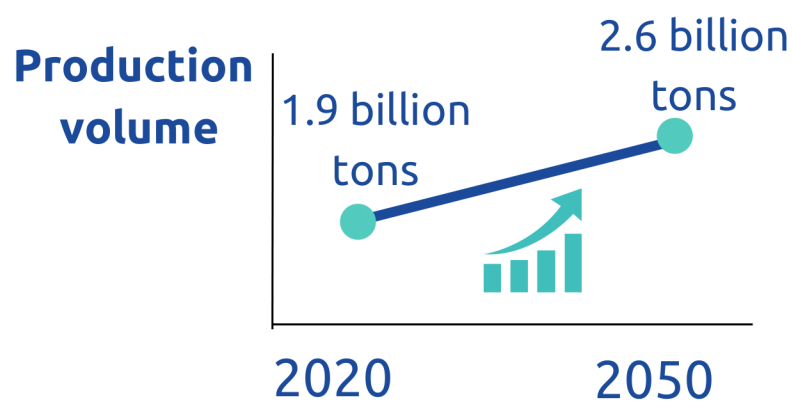
→ Steel has revolutionized the world and is present everywhere around us due to it being

100% recyclable

Flexible

Strong & Durable

→ Steel is one of the **most consumed materials** today



+36% growth expected by 2050 via



Population growth



Energy transition



Sustainable buildings

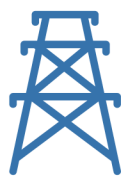


Automotive industry

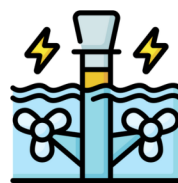
→ Steel is a **critical input** for the net-zero transition



*Solar PV
Modules*



*Electricity
networks*



Tidal

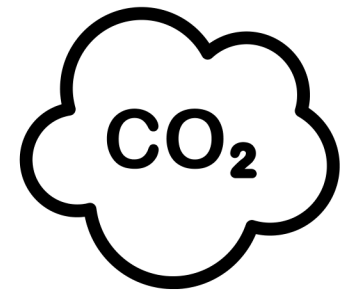


*Wind
Turbines*

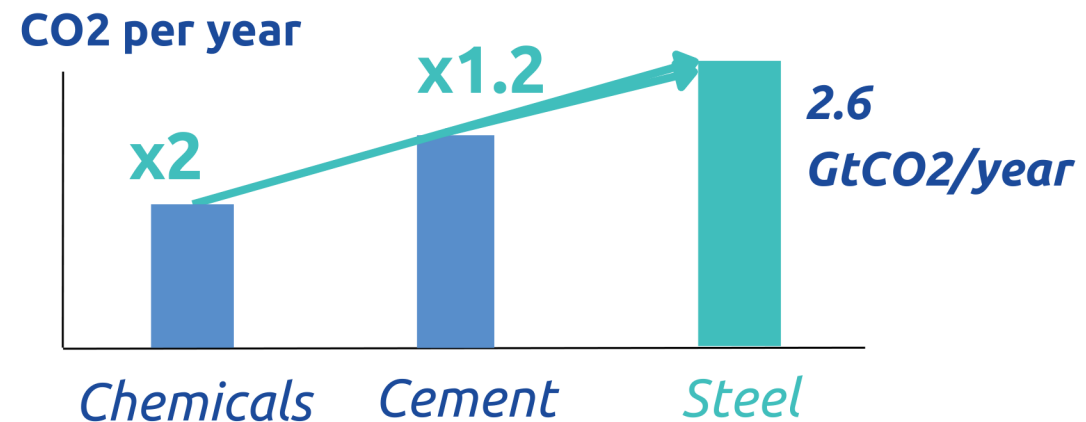


Hydro

... with a massive need for decarbonisation



→ Steel is one the **most polluting heavy industries**, ahead of chemicals and cement



→ **7%** of global GHG emissions (*more than all road freight*) ... with significant increase ahead if no actions are taken

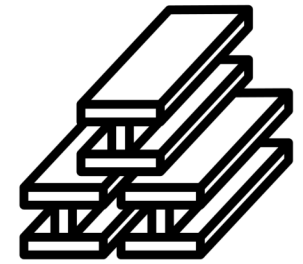
→ Steel is considered to be a **hard-to-abate** sector, due to

- ↑ High lifespan of assets (*40 years on average*)
- ↑ High asset replacement costs
- ↑ High decarbonization energy requirements

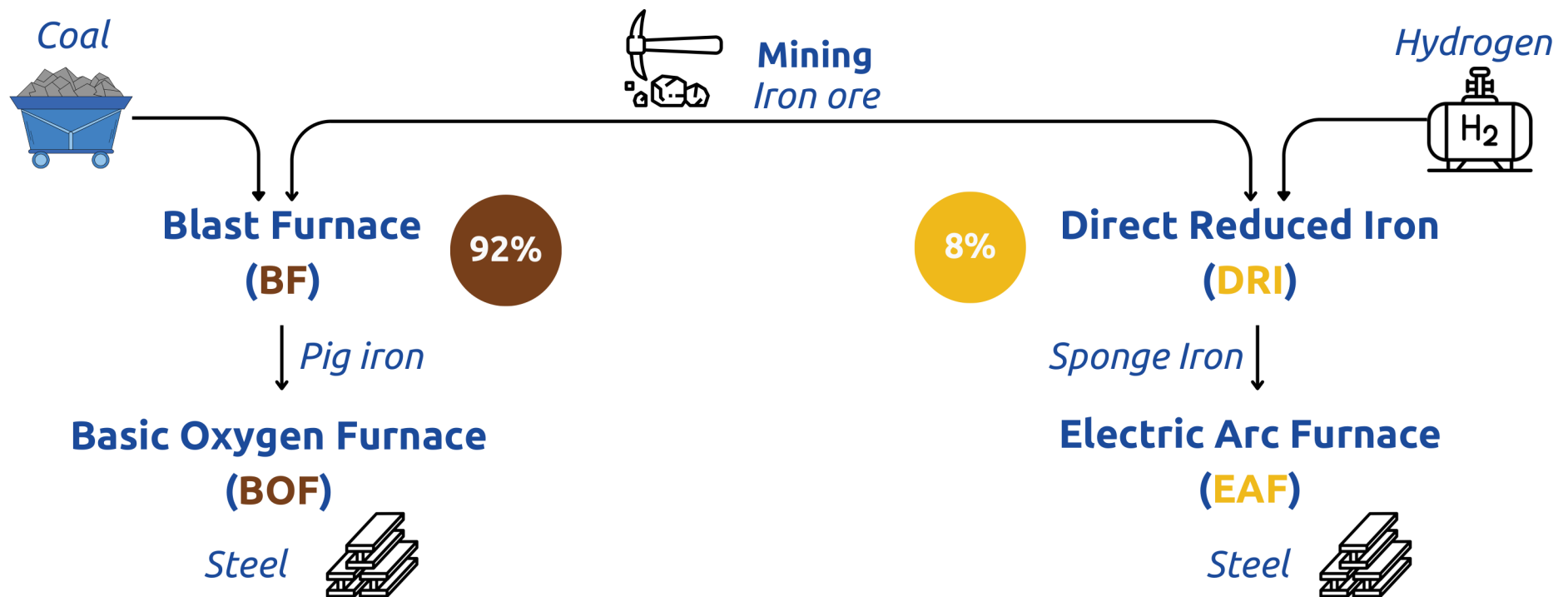
→ Hence the **challenge for 2050**

↓ **-80%** on CO2 emissions while ↑ **+36%** in production

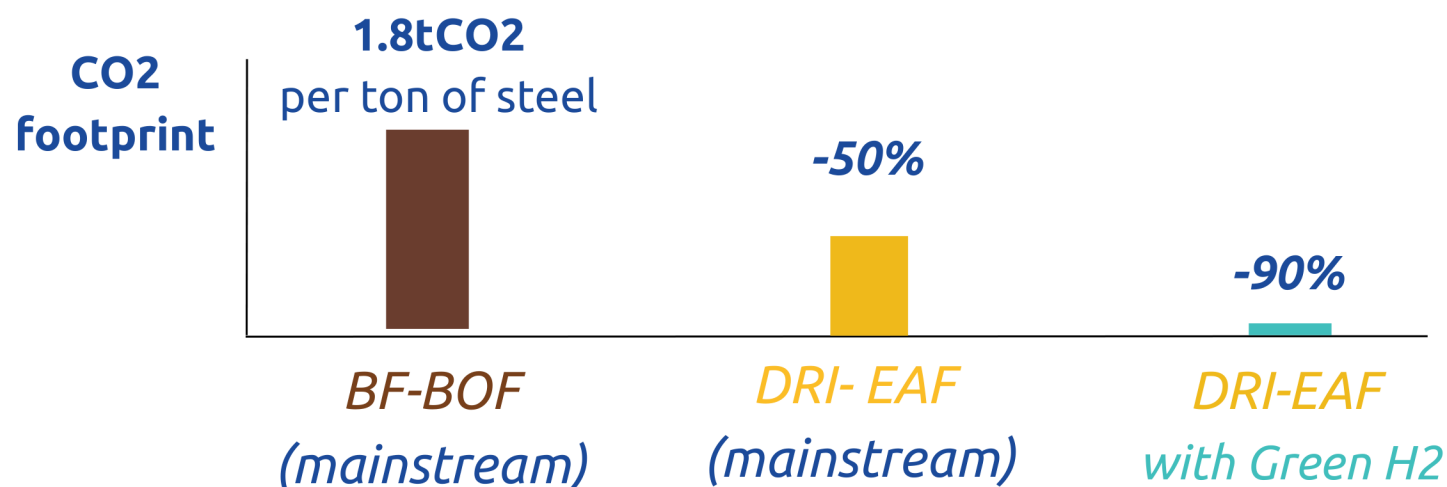
Cleaning up the steel industry...



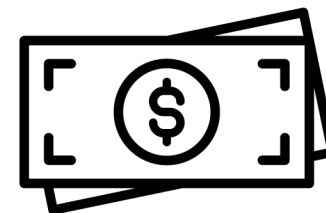
Two ways of producing steel today



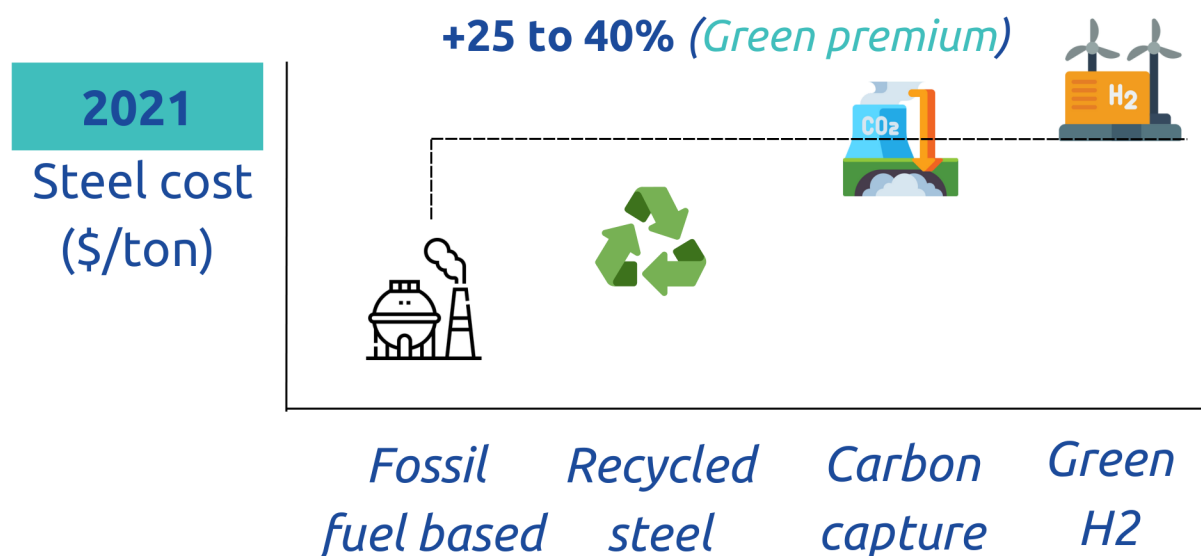
- Hydrogen is already used today in the steel value chain (in the **DRI** process) but only marginally compared to coal in **BF** (92% of global iron production)
- Green hydrogen use in **DRI-EAF** process can significantly reduce CO2 footprint



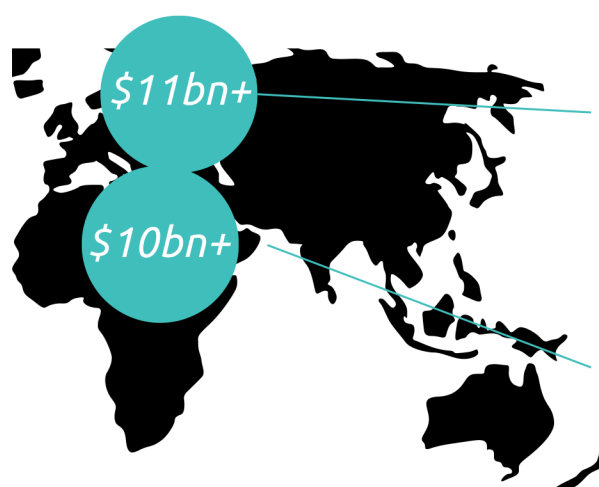
... but at a green premium



→ Currently, Green H2 based Steel is **more expensive** than conventional steel and low-carbon alternatives



But steel majors are already announcing/making significant investment in the green steel value chain (*\$21bn+ planned*)



Europe

Close to offtakers
and green grid
stability



H2green steel



SSAB

MENA

Untapped RE
potential / Lowest
production cost



posco

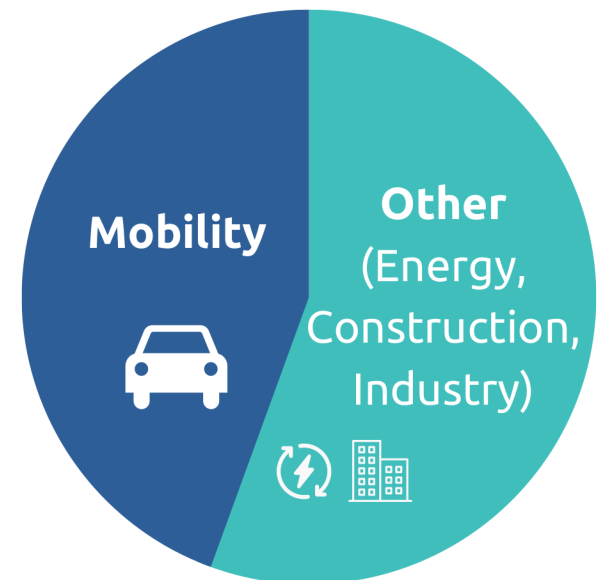


VALE

Mobility in Europe and Asia are paving the way



- Even if coming with a green premium, green steel offtake agreements have already been signed in **Europe and North East Asia**
- Main momentum is for the **mobility** sector, which represents:
 - **20% of global steel demand, but**
 - **44% of signed green steel offtake**

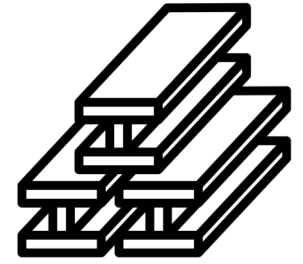


2023 Green Steel Offtakers (Signed)

Why?

- ✓ Lesser consumption means green products are *easier to integrate*
*25% increase in the price of steel would **only raise vehicle production costs by 1%.***
- ✓ Mobility regulations are made on a lifecycle basis, making the sector more sensitive to decarbonisation efforts
e.g. EU Regulation (EU) 2019/631

Conclusion: Green Hydrogen role for Steel



- Steel is a **crucial material** in today's economy and for the energy transition
- However, it is **one of the hard-to abate sectors**
- There is full potential to decarbonise the steel industry using **green hydrogen in Direct Reduced Iron (DRI) process** and **renewable electricity for smelting**, but the process is expensive currently
- But even at the cost of a green premium, the current offtake agreements (mainly in the *mobility sector in Europe and Asia* with *major investment zones being Europe and MENA*) pave a concrete way for green steel as demand is expected to account for **50% of the total steel demand by 2040**
- In **2050**, green steel is expected to be cheaper than conventional steel everywhere on the globe, making today's efforts highly valuable for the sector decarbonisation

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