

# ArcelorMittal

## Carbon Neutrality plan

### UNECE presentation

March 25, 2022  
AM Group CTO



# Table of Content

**Presentation of AM steel production Group**

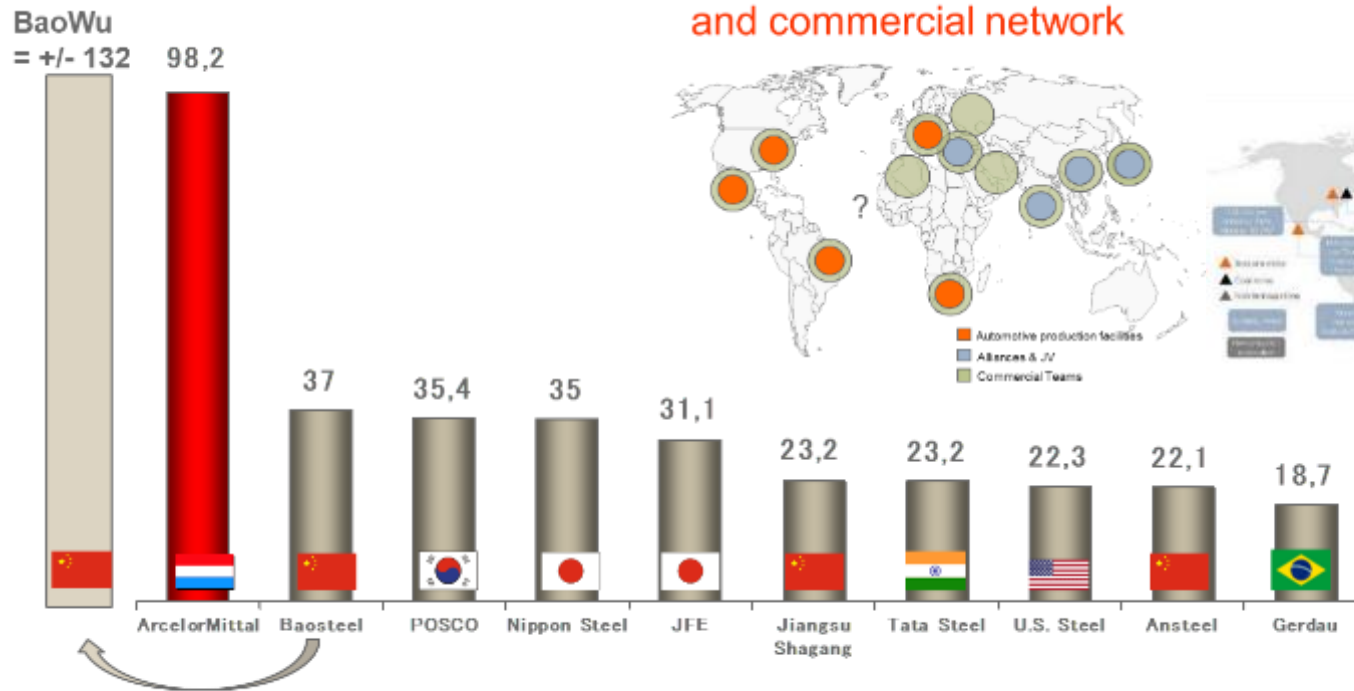
**The AM carbon neutrality plan**

Three pathways

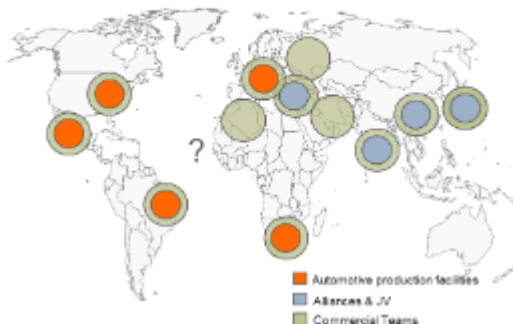
- Electrical steelmaking
  - Gas based steelmaking
  - Carbon based steelmaking
- CCU and CCS are complementary

## The ArcelorMittal steel production group

# Largest steel producers (in mt crude steel)



## ArcelorMittal's industrial and commercial network



## Mining business portfolio



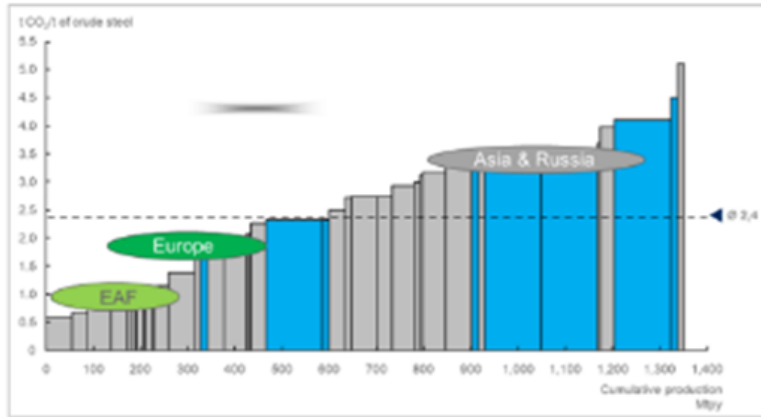
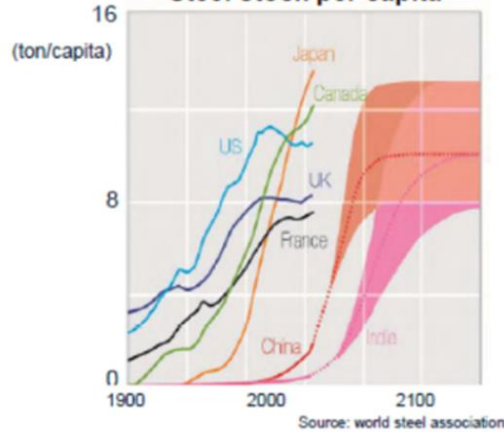
\* Source: Worldsteel

**Steel is a product of the past that has largely  
contributed to our current standard of life .....**

**And will continue to do so on our road to Carbon  
Neutrality...**

# Steel : a product of the past and for the future

Steel stock per capita



global CO<sub>2</sub> curve

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15/03/2022  
Confidential

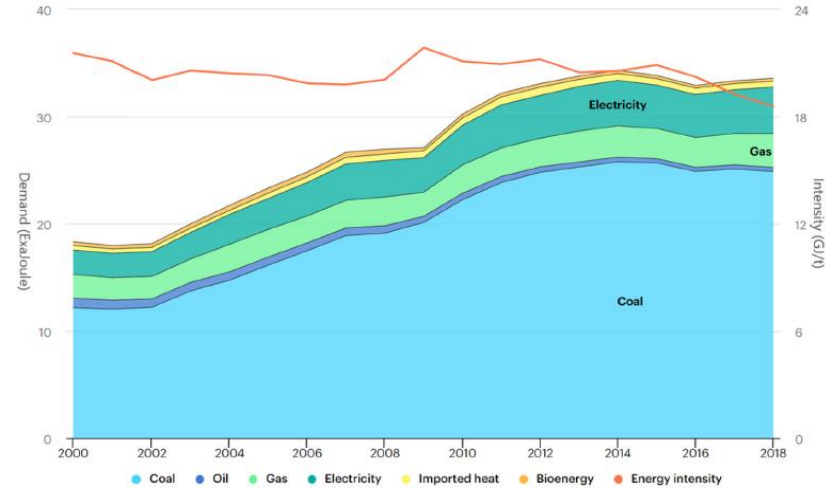
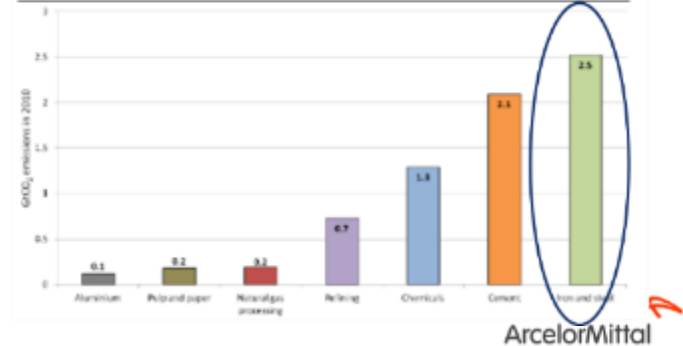


Fig. 1. Energy demand and intensity of the global iron and steel industry (2000-2018).

Steelmaking = generating 7% of the anthropogenic emissions

Figure 1. Global emissions from the seven most CO<sub>2</sub>-intense industrial sectors in the IEA Energy Technology Perspectives (ETP) analysis

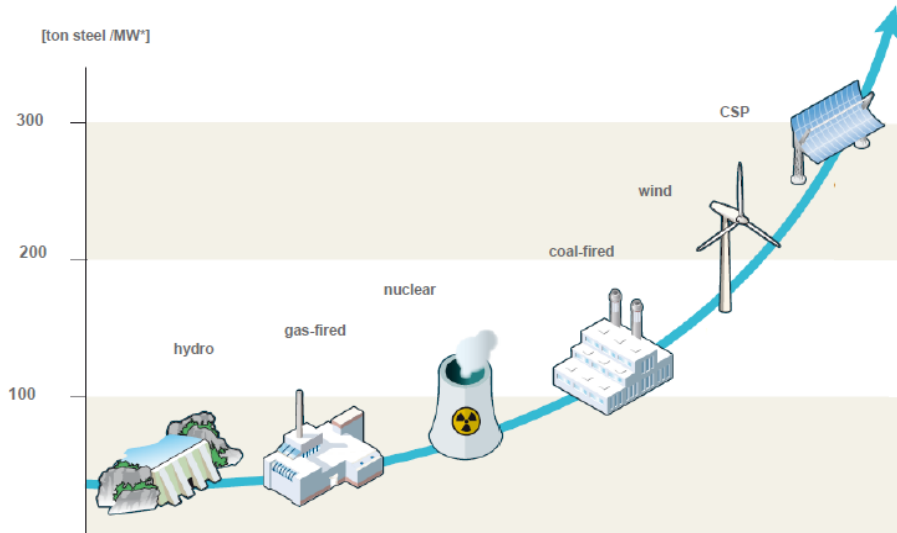


## Steel : a product of the past and for the future



# [ Steel supports a Sustainable Circular Economy ]

- Steel is fully recyclable (magnetic) -> real C-footprint = 0,86 t CO<sub>2</sub>/T
- It can be produced in a carbon neutral way
- Steel is base material to install equipment for renewable technologies



\* steel consumptions per installed MW capacity

Classified as ArcelorMittal Public



# Sustainable development

## The ArcelorMittal carbon neutrality plan

Climate Impact ArcelorMittal

ca 200mt CO<sub>2</sub> Emissions

# The 3 pathways of the ArcelorMittal decarbonation plan .....



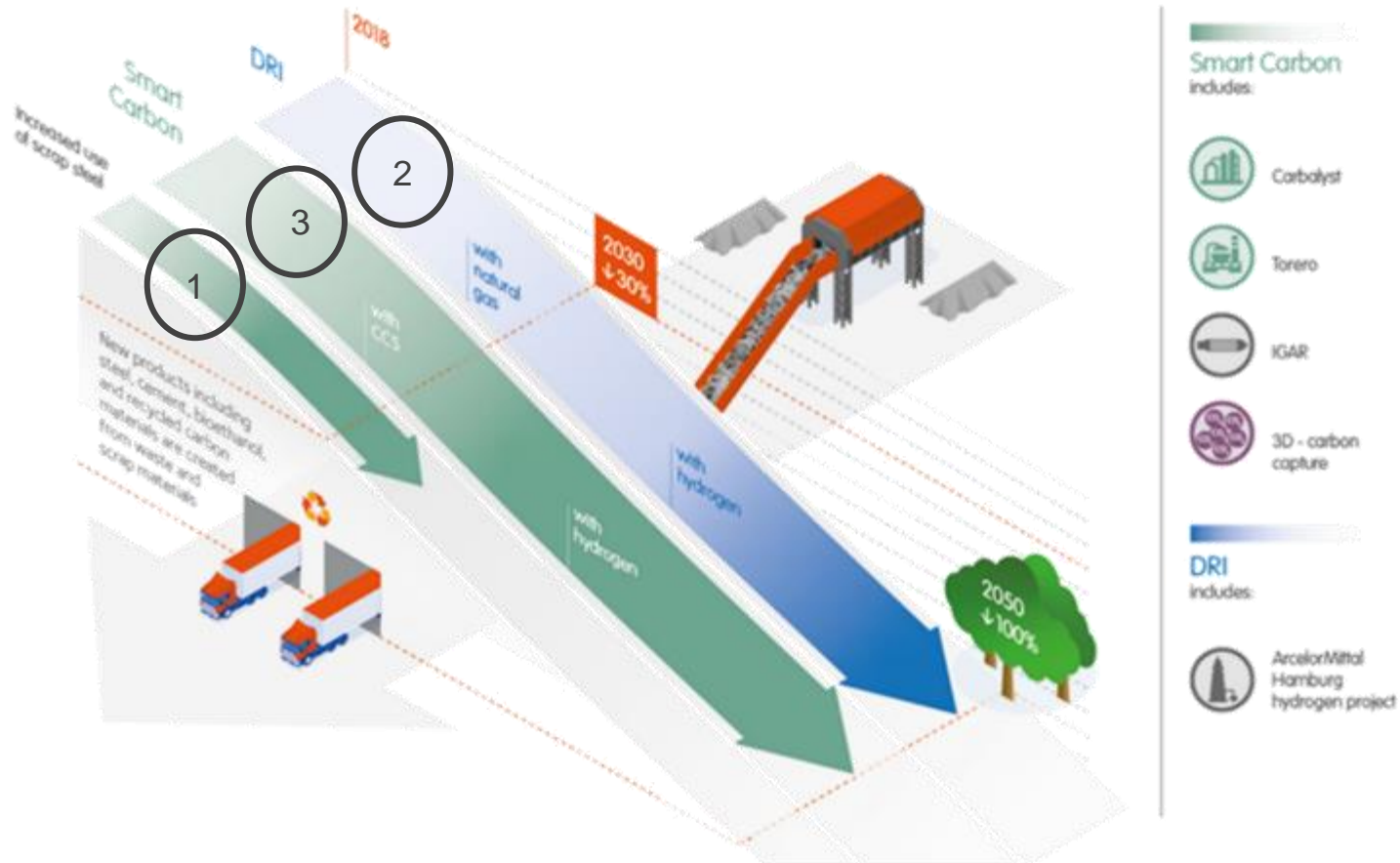
<https://www.worldsteel.org/media-centre/industry-member-news/2019-member-news/ArcelorMittal-publishes-first-Climate-Action-report.html>





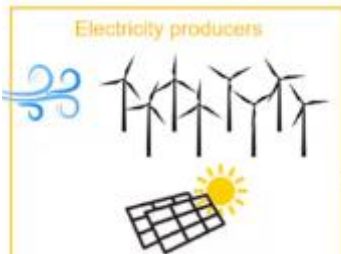
# AM : decarbonation plan

## 3 pathways

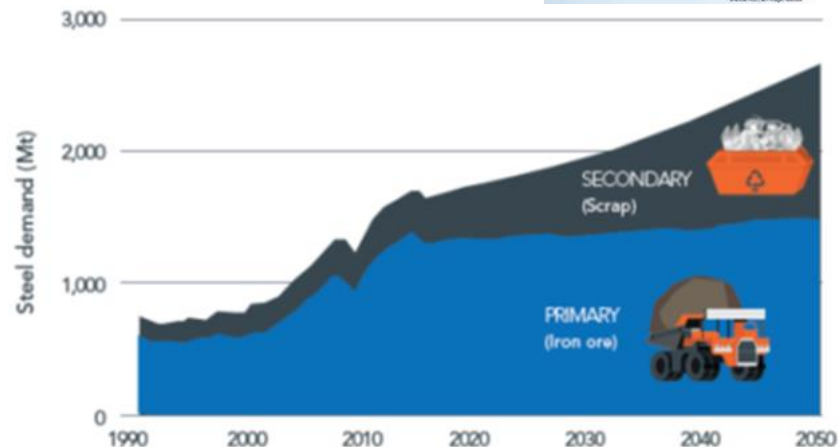
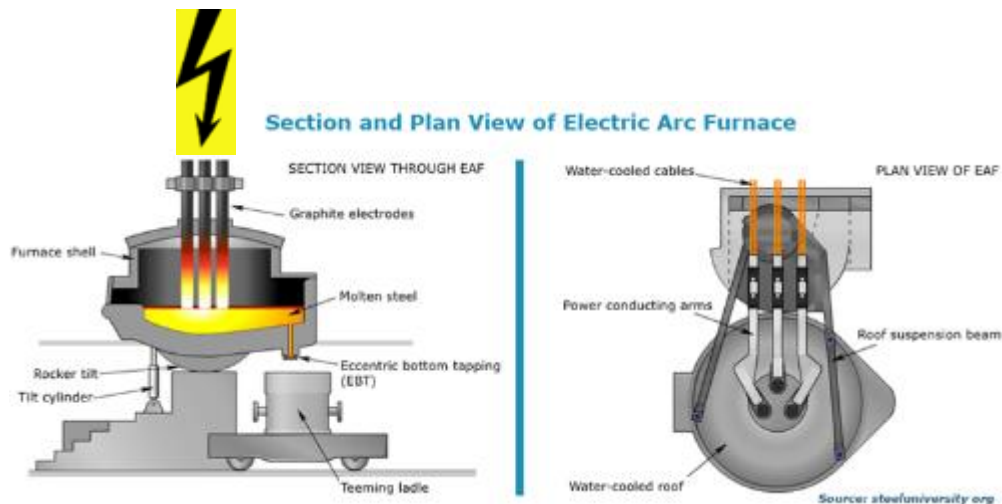


# AM : decarbonation plan : pathway 1

Electrical steelmaking using low carbon electricity :



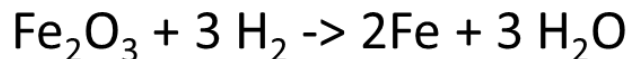
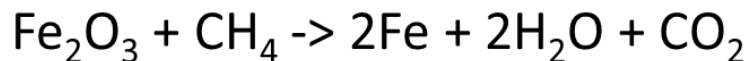
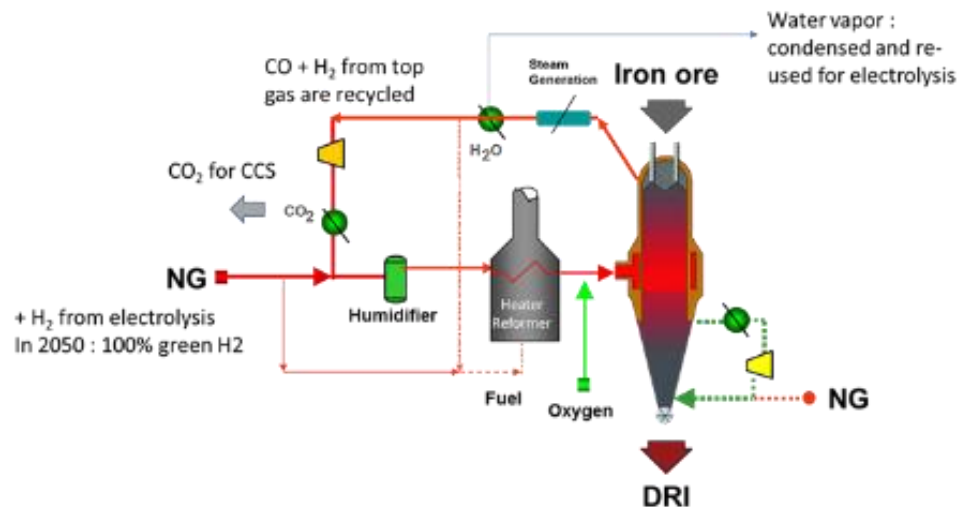
Section and Plan View of Electric Arc Furnace



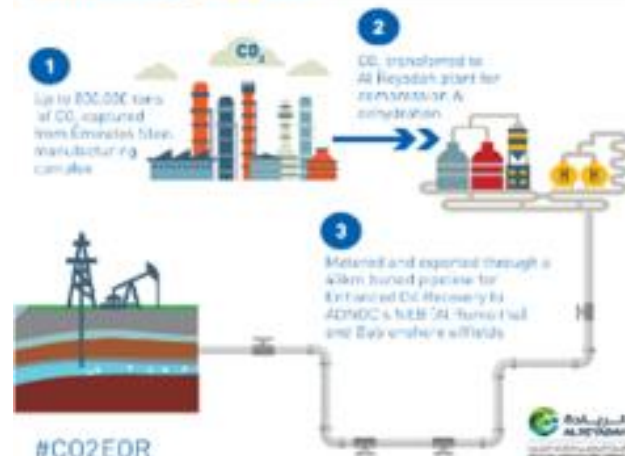
# AM : decarbonation plan : pathway 2A + B

Gas based steelmaking, able to use hydrogen :

## HYL-ZR Process

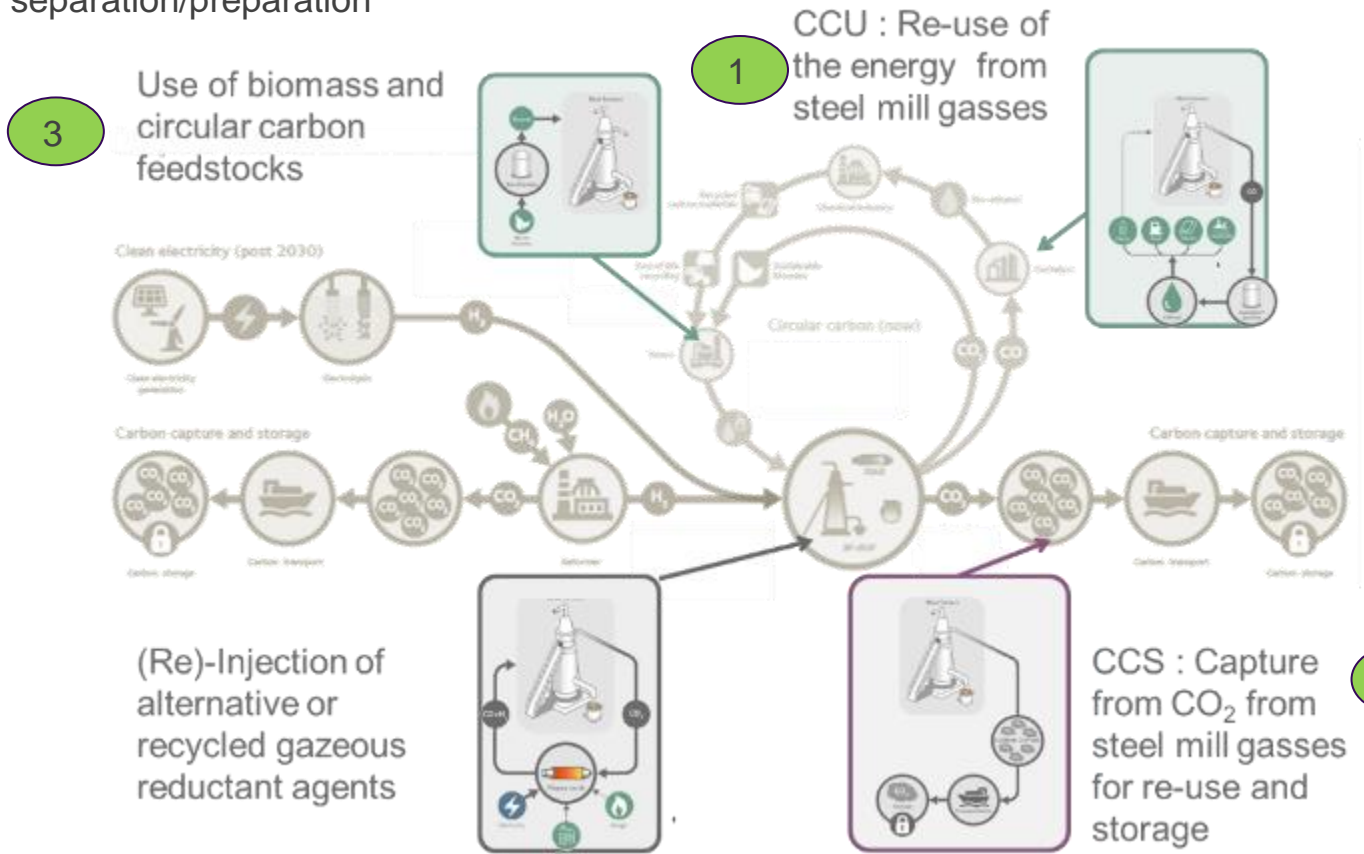


## Al Reyadah Carbon Capture Usage and Storage (CCUS)

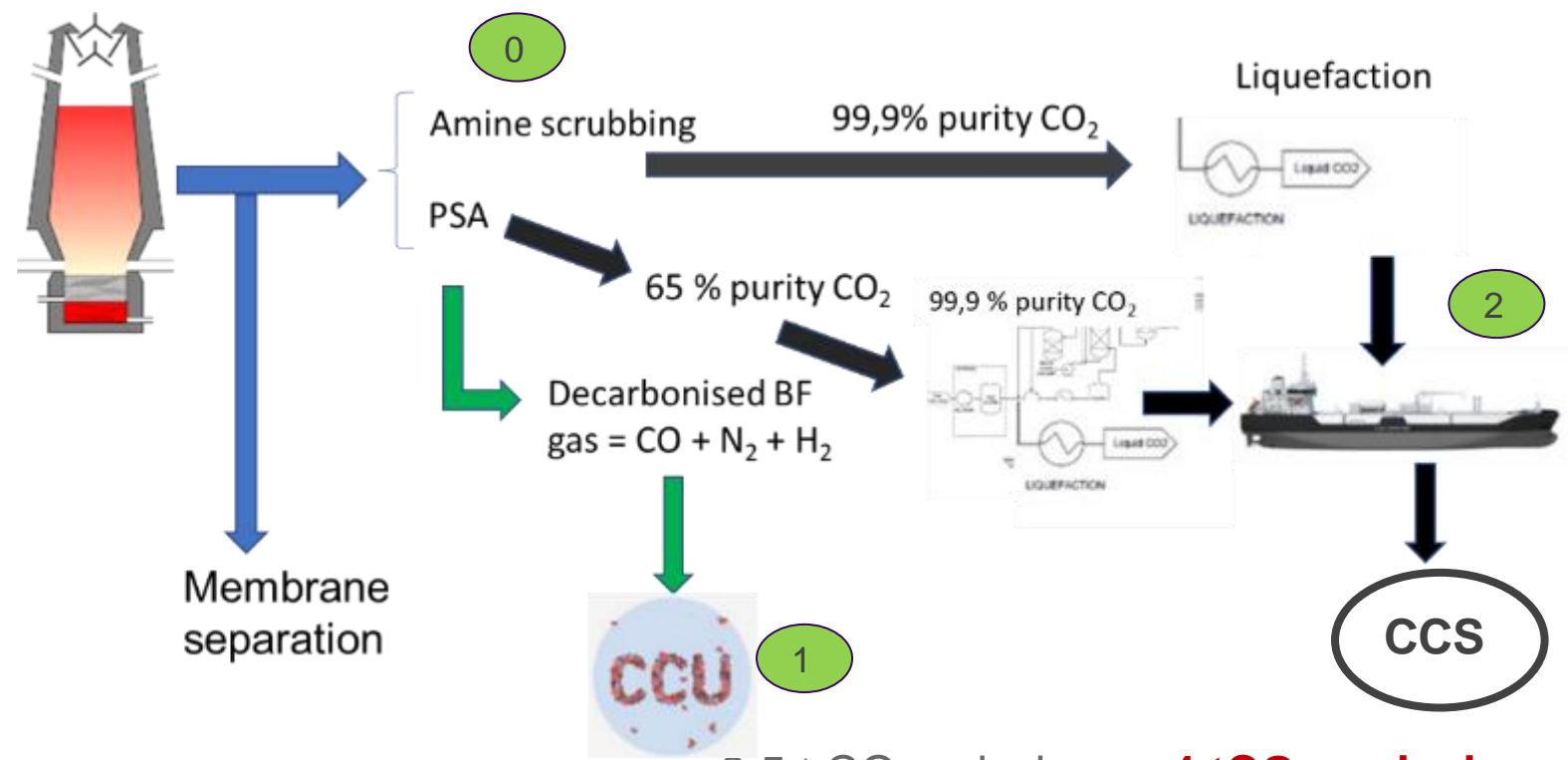


Principles of the ArcelorMittal Carbon Neutrality plan In conventional steel making

0 = gas separation/preparation



Separation of the chemical energy of the gasses allows to re-use it instead of burning it



2,5 t CO emission -> **4 tCO<sub>2</sub> emission**

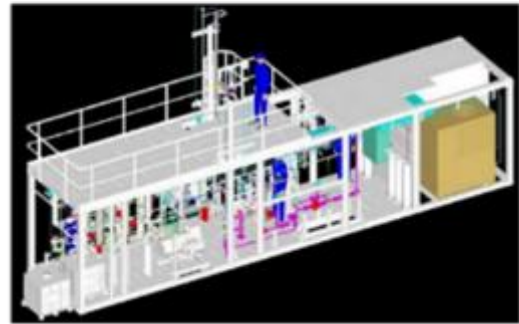
+ 3,5 t CO<sub>2</sub> emission 



# ArcelorMittal : Smart Carbon Usage

CO/CO<sub>2</sub> separation pilots : 0

Carbon2Value : pilot project 2018 – 2020  
INTERREG sponsored project



Other steel makers act in the same way :



Membrane separation :

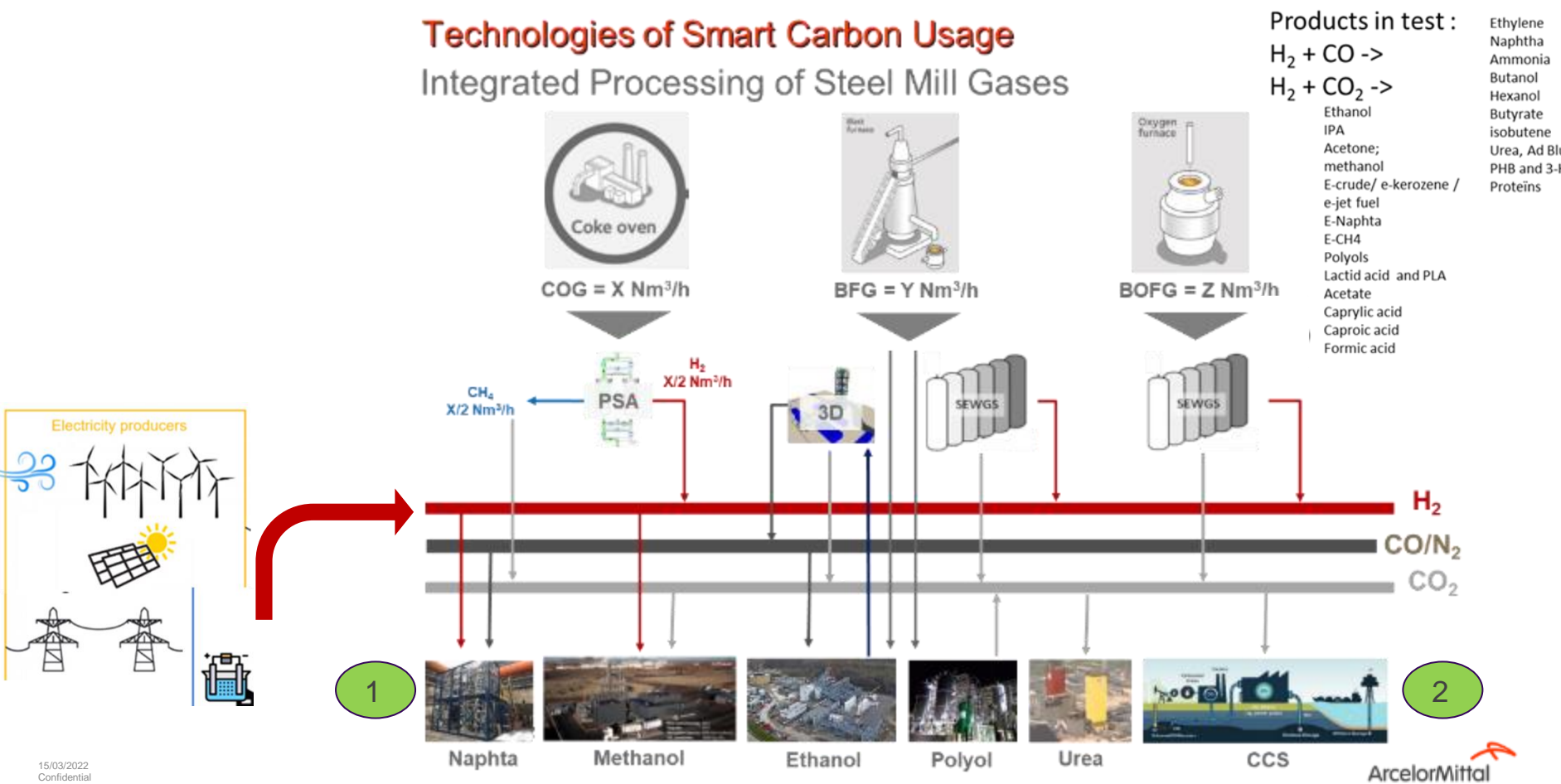


Capture of 0,5 t/h CO<sub>2</sub> from 1.100 Nm<sup>3</sup>/h BF-gas to study feasibility

Steelanol : PSA  
100.000 Nm<sup>3</sup>/h  
(320 kT CO<sub>2</sub>/a)  
ArcelorMittal

## Technologies of Smart Carbon Usage

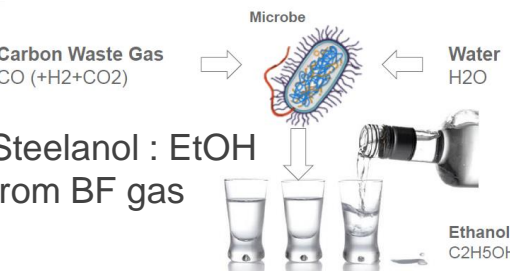
### Integrated Processing of Steel Mill Gases





# ArcelorMittal : Smart Carbon Usage

## CCU plant and pilots : 1



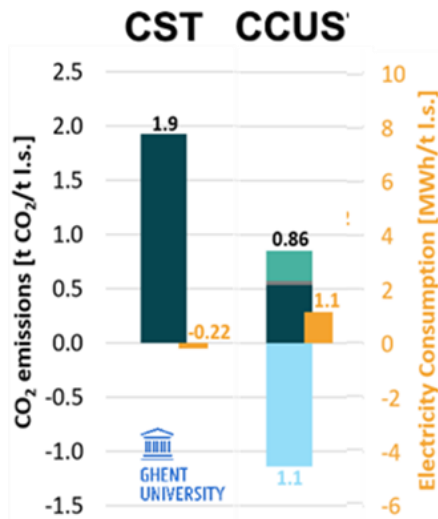
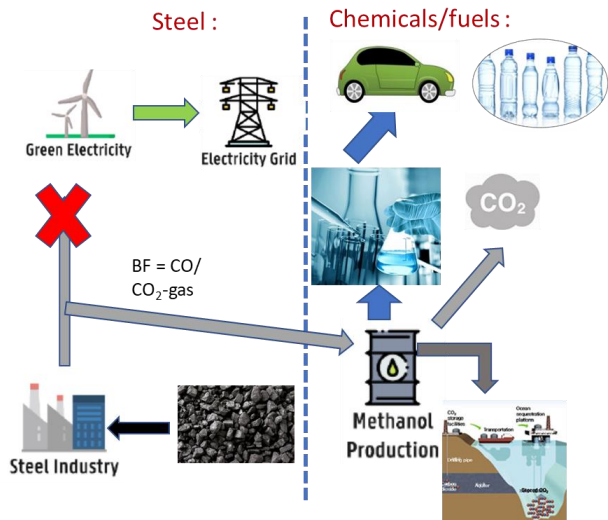
Steel2Chemicals  
Naphtha  
From BF gas and  
COG



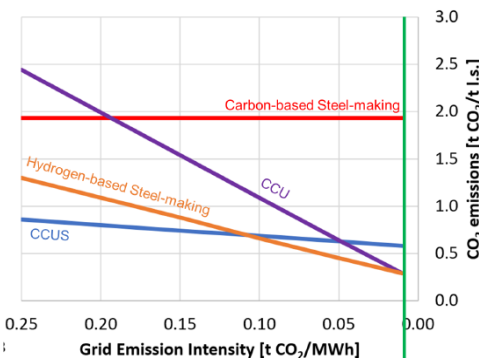
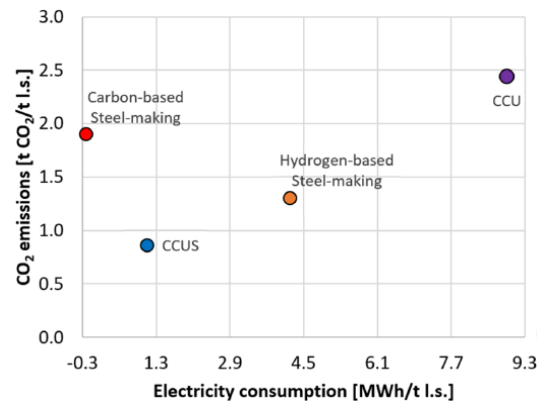
FReSMe  
MeOH from BF Gas



# CCU is an enabler of CCS : MeOH LCA shows the complementarity of CCU and CCS



Grid Emission Intensity = 0.25 t CO<sub>2</sub>/MWh



## Current EU-grid

If all of the steel mill gas is converted, the CO<sub>2</sub> abatement potential is :

- CCU = 360 kg/t by MeOH-production (30%)
- CCS = 740 kg/t by storage of the CO<sub>2</sub> (70%)
  - 400 kg/t of the steel gas CO<sub>2</sub>
  - 340 kg/t of the electricity CO<sub>2</sub>

Total abatement = 1.100 kg/t

Need for renewable electricity = 1,1 MWh/t steel