

# The ArcelorMittal Strategy towards Carbon Neutral Steel Production: The Smart Carbon Pathway

Innovations to Decarbonise the Steel Industry  
WEBINAR INDUSTRY INSIGHTS

Wim Van der Stricht, ArcelorMittal



ArcelorMittal



# Towards Carbon neutral steel



ArcelorMittal



# Leadership of the steel industry's journey to carbon neutrality

ArcelorMittal is at the forefront of the industry, developing clear industrial transformation plans and capturing commercial opportunities

## ArcelorMittal Climate Action Report 2 – July 2021

## Climate Action in Europe – June 2020

## XCarb™

*“Steel is already the material of choice due to its lower carbon footprint and infinite recyclability. Crucially, as we decarbonise further, zero carbon-emissions steel has the potential to be the backbone of the buildings, infrastructure and transport systems that will enable governments, customers and investors to meet their net-zero commitments.” – A. Mittal*

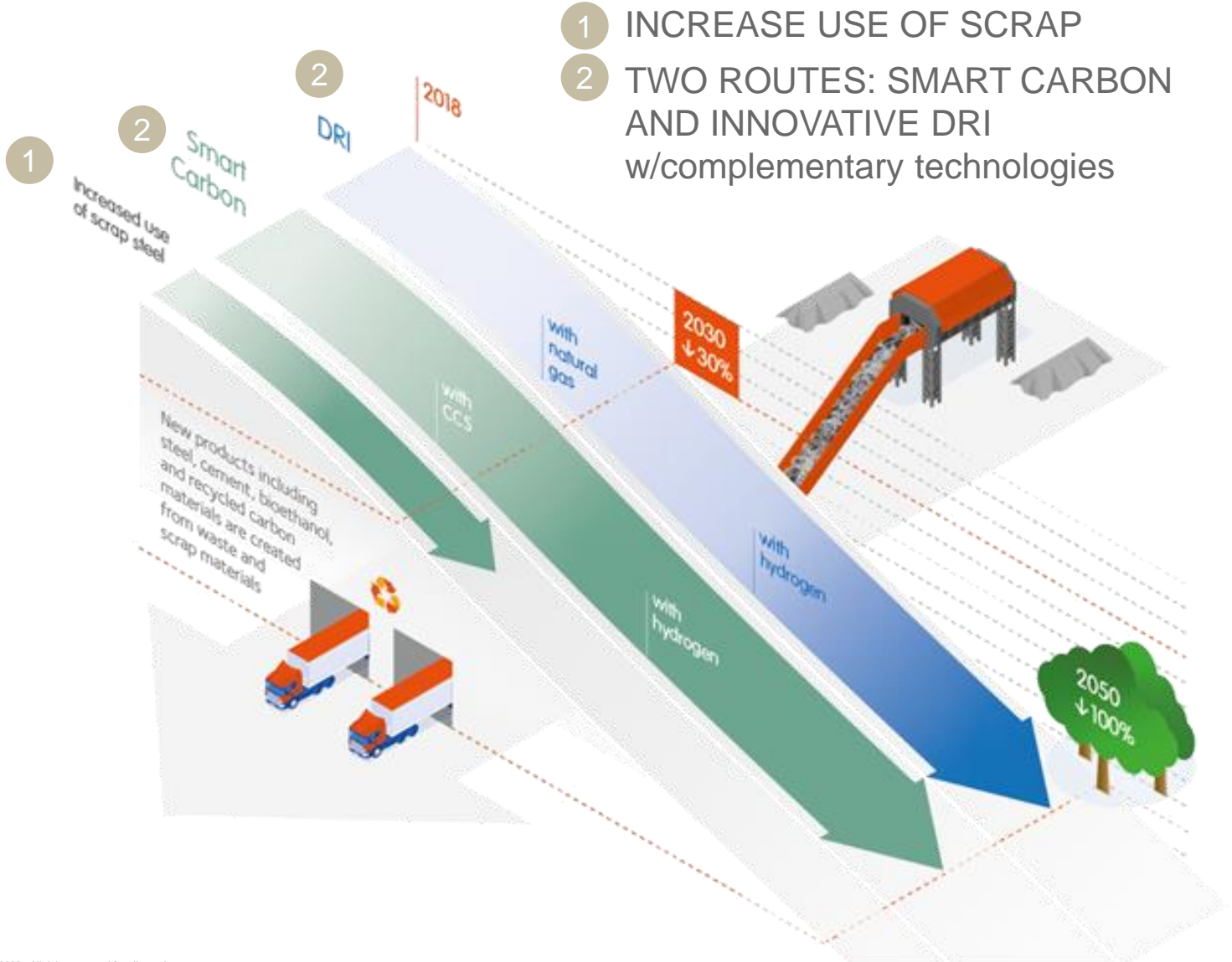
See <https://corporate.arcelormittal.com/climate-action> & <https://corporate.arcelormittal.com/climate-action/xcarb>



**XCarb™**  
Towards carbon neutral steel

**Smarter steels for  
people and planet**

# ArcelorMittal roadmap to low-emissions steelmaking



- 1 INCREASE USE OF SCRAP
- 2 TWO ROUTES: SMART CARBON AND INNOVATIVE DRI w/complementary technologies

## Smart Carbon



Steelanol



Torero



Top gas recycling



3-D

## DRI



DRI plants

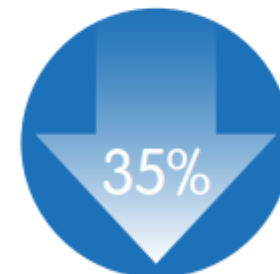
## Emerging



Direct Iron Electrolysis



New Group target of a 25% reduction in CO<sub>2</sub>e emissions intensity by 2030 (scope 1 and 2)



Europe target increased to 35% reduction in CO<sub>2</sub>e emissions intensity by 2030 (scopes 1 and 2)

# The smart carbon technologies



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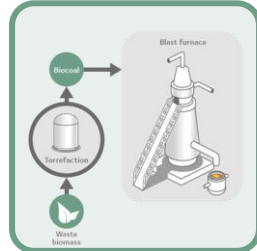


# Our roadmap: Smart Carbon technologies

## Torero

*converts waste wood into bio-coal, replacing the coal currently injected as a reductant*

Large-scale demo plant in Ghent, Belgium

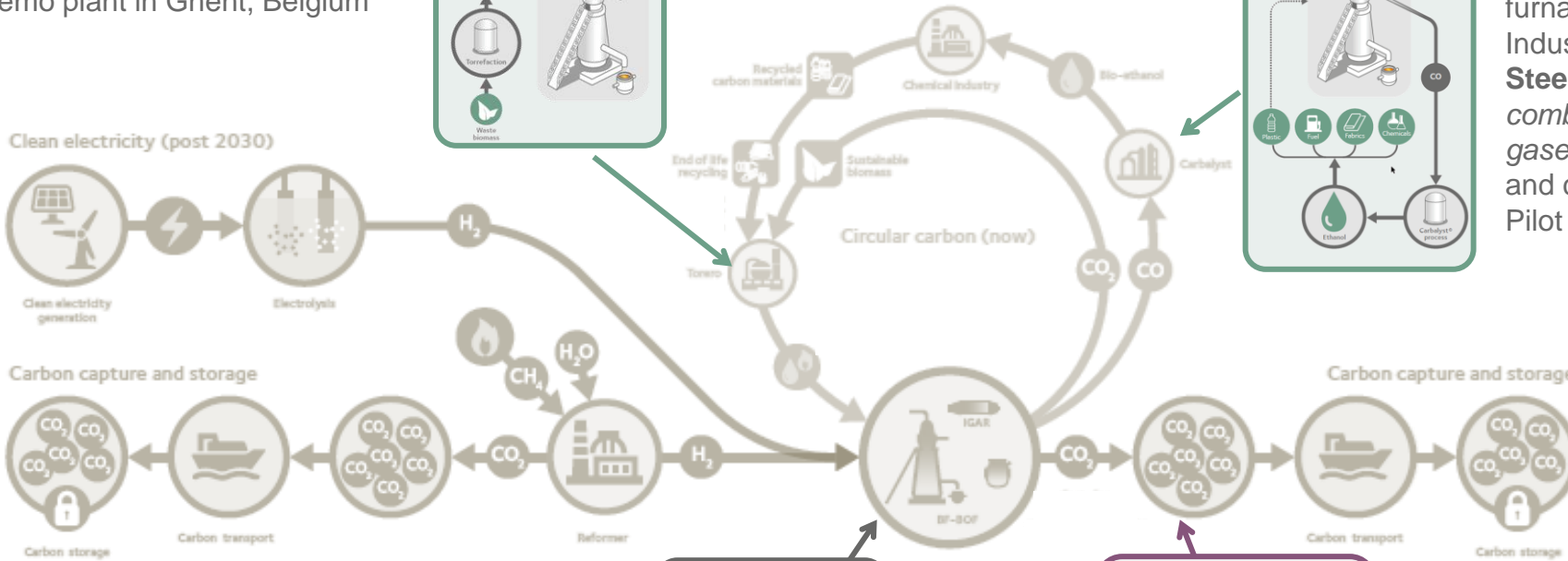
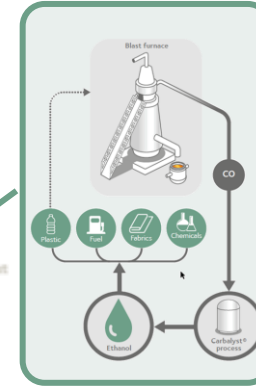


## Carbalyst (Steelanol)

*captures carbon off-gases from the blast furnace and converts into ethanol*  
Industrial demo plant in Ghent, Belgium

## Steel2Chemicals

*combines captured carbon off-gases from the blast furnace with hydrogen and converts into naphtha*  
Pilot plant in Ghent, Belgium

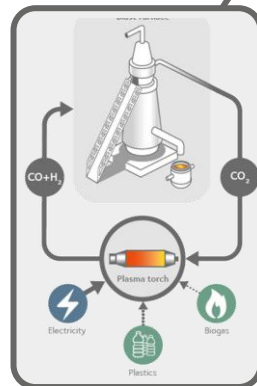


## Gas injection

*in operation in various plants example RecHycle project in Gent*

## Top Gas Recycling

*captures waste CO<sub>2</sub> and waste hydrogen from the steelmaking process and internally converts it into synthetic gas to replace fossil fuels*  
Industrial-scale pilot in Dunkirk, France

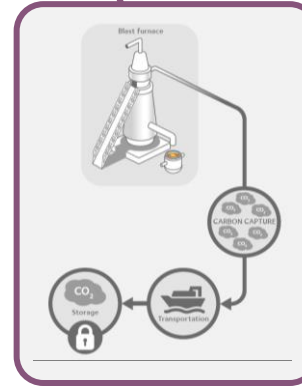


## Carbon2Value, MHI pilot

*carbon capture of off gases*  
Pilot projects in Gent, Belgium

## 3D

*carbon capture of off gases*  
Pilot project in Dunkirk, France  
Captures 0.5 metric tonnes of CO<sub>2</sub> an hour



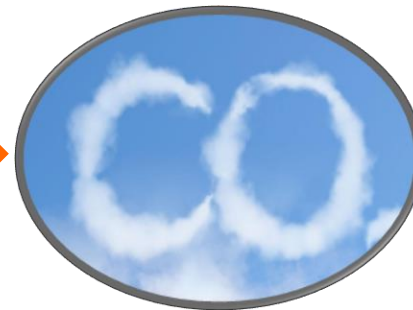
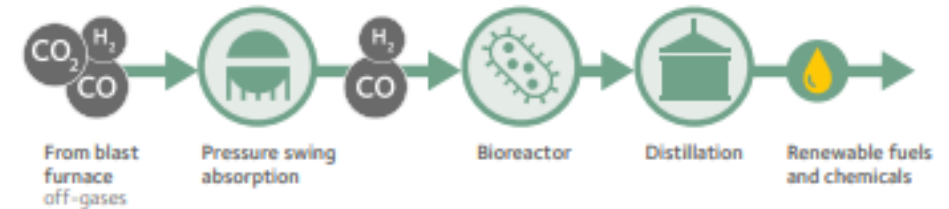
# Steelanol and Torero: converting waste wood into sustainable fuels and chemicals



Torero

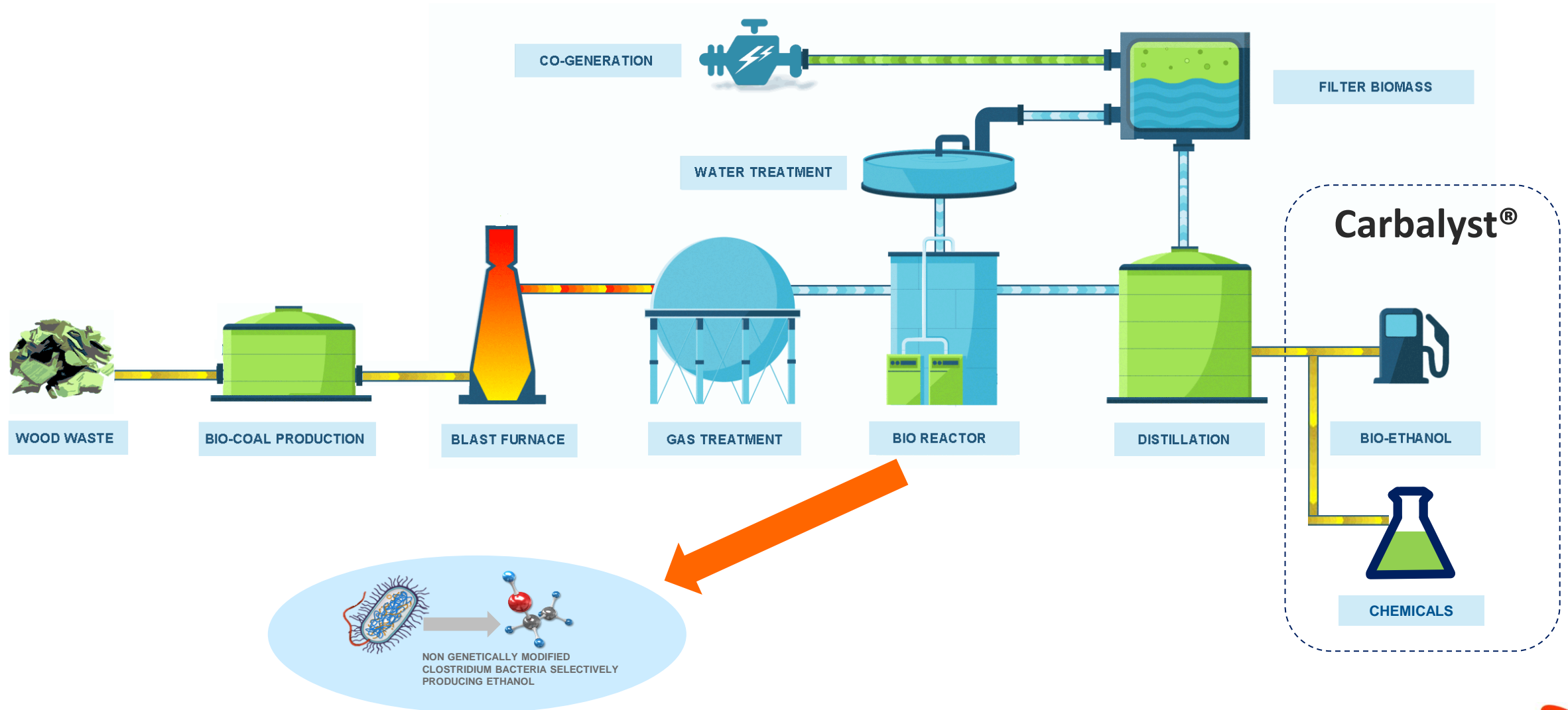


Steelanol



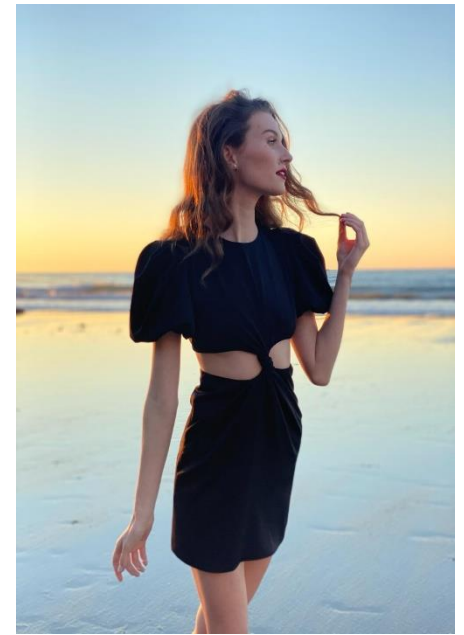
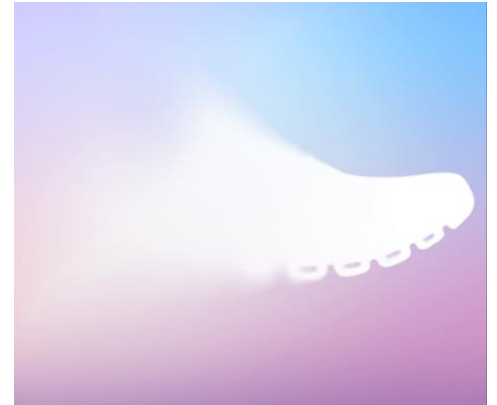
Investment cost : ~235 meuro  
 CO<sub>2</sub>-impact: ~350 kton/year  
 Start-up: 2023

# Steelmanol and Torero: converting waste wood into sustainable fuels and chemicals





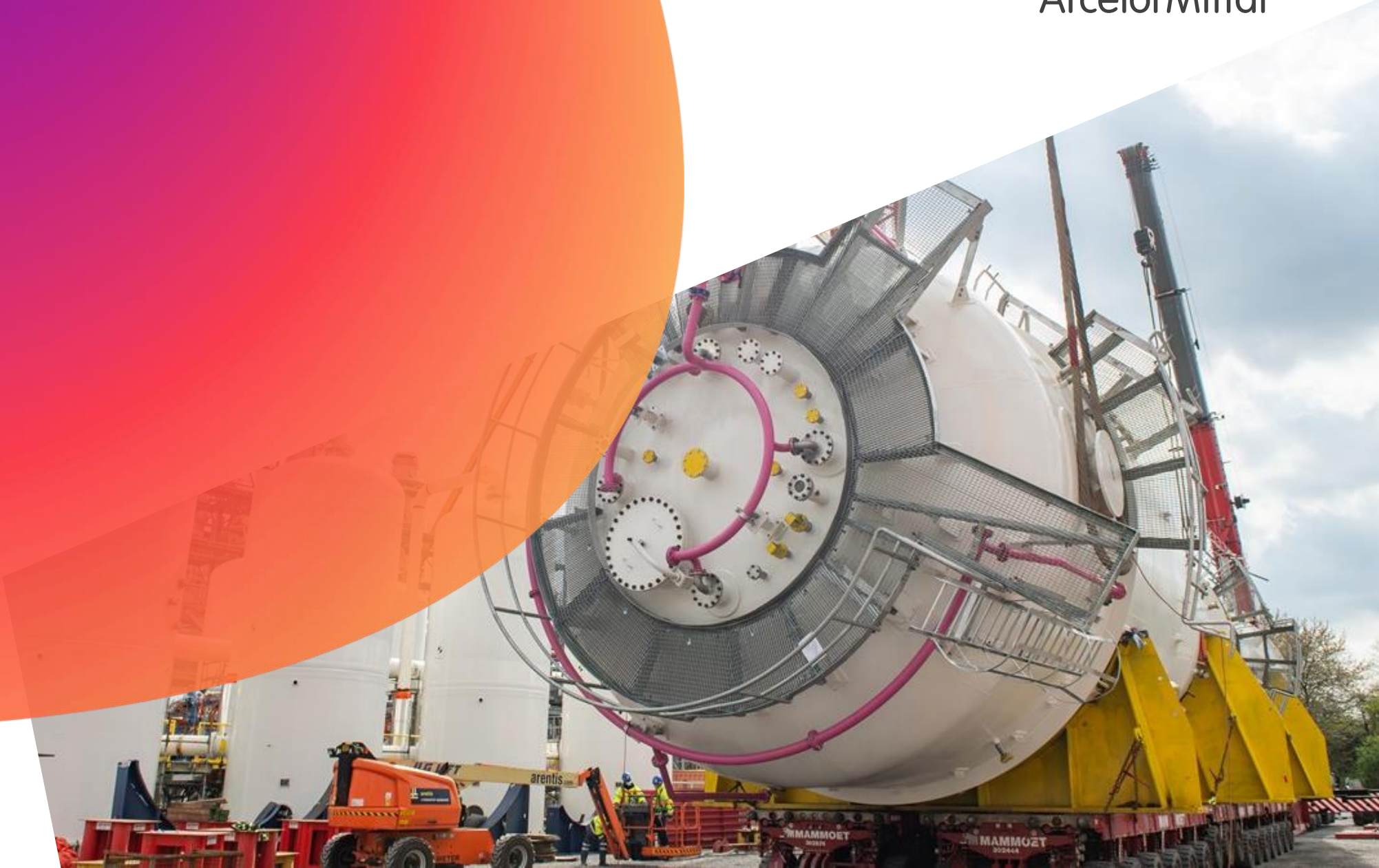
# CCU based “CarbonSmart™” Chemicals: many applications and high demand



# Demonstration projects



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Blast Furnace

Torero

Steelanol

Ethanol handling and storage

# Steelmanol: January 2019



# Steelmanol: September 2020



# Steelanol: December 2020



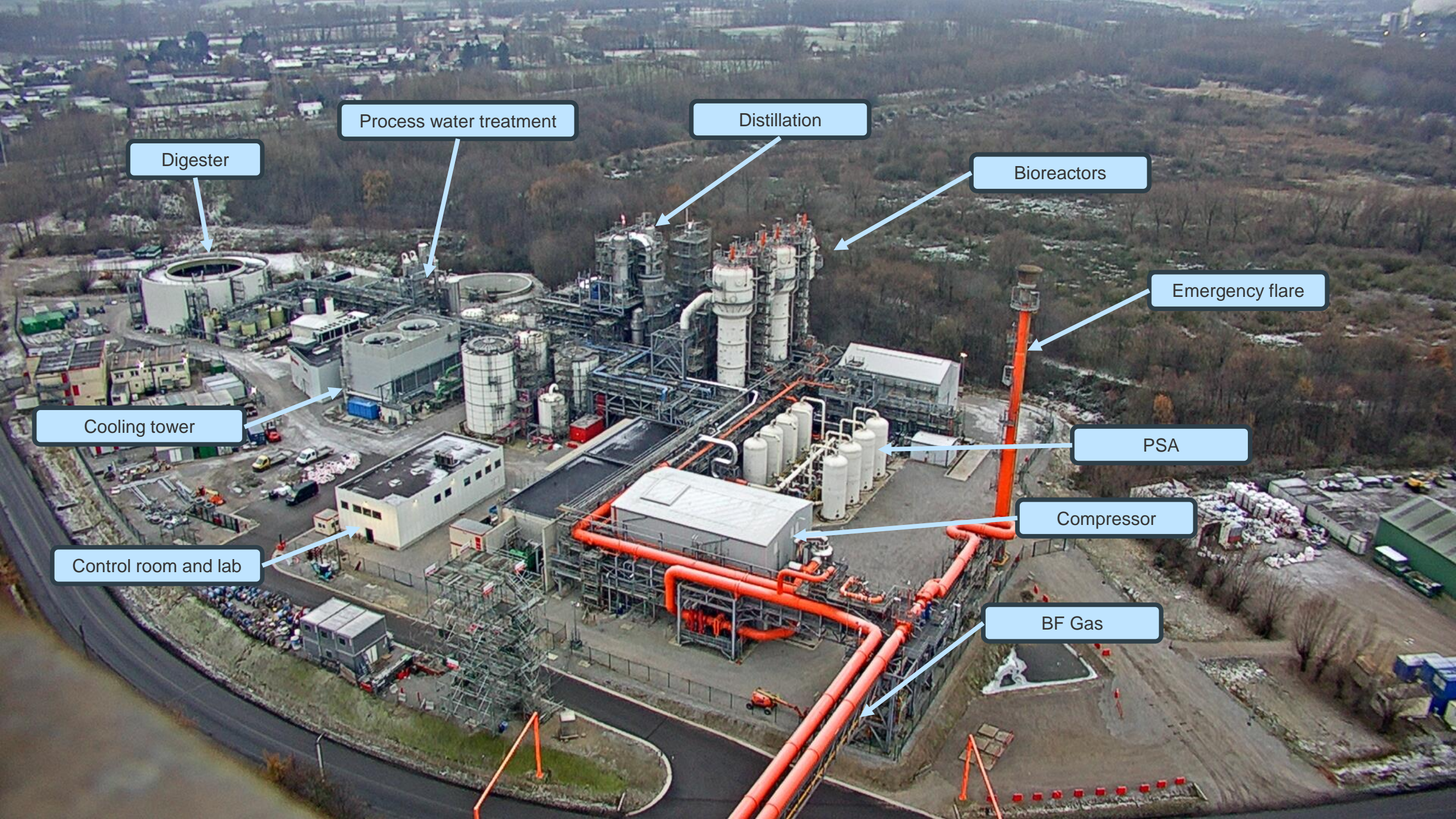
# Steelmanol: September 2021



# Steelanol: today







Process water treatment

Distillation

Digester

Bioreactors

Emergency flare

Cooling tower

PSA

Control room and lab

Compressor

BF Gas

## Steelmanol milestone achieved in June 2023

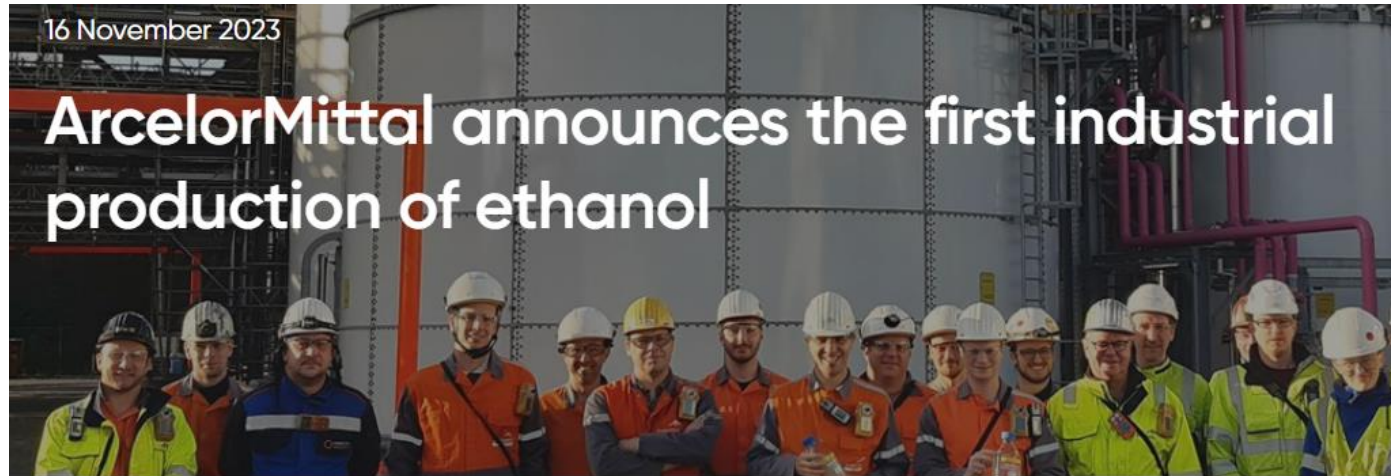
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14 June 2023

**ArcelorMittal and LanzaTech announce first ethanol samples from commercial flagship carbon capture and utilisation facility in Ghent, Belgium**

# Steelanol milestone achieved in November 2023

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## ArcelorMittal announces the first industrial production of ethanol

ArcelorMittal announces the first industrial production of ethanol at its Steelanol plant, Europe's first carbon capture and utilisation (CCU) project. This historic milestone was achieved on 7 November 2023, at ArcelorMittal Belgium's Gent plant. The first industrial-scale production is a significant step in the journey to the full commissioning of the Steelanol plant. Throughout the project, ArcelorMittal has worked with its partners LanzaTech, Primetals Technologies and E4Tech.

# Steelanol: trucks of ethanol shipped to customer (perfume producer)

**14 trucks (360 ton)**



September 2024

## Steelanol: first barge of ethanol shipped **(600 ton)**

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11 December 2024

**ArcelorMittal and LanzaTech Announce  
Ethanol Production Milestone and Shipment  
of First Barge from Flagship Steelanol  
Facility in Belgium**

# Torero: March 2021



# Torero: June 2021



Torero: February 2022



VEENT  
→



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# Torero: February 2022

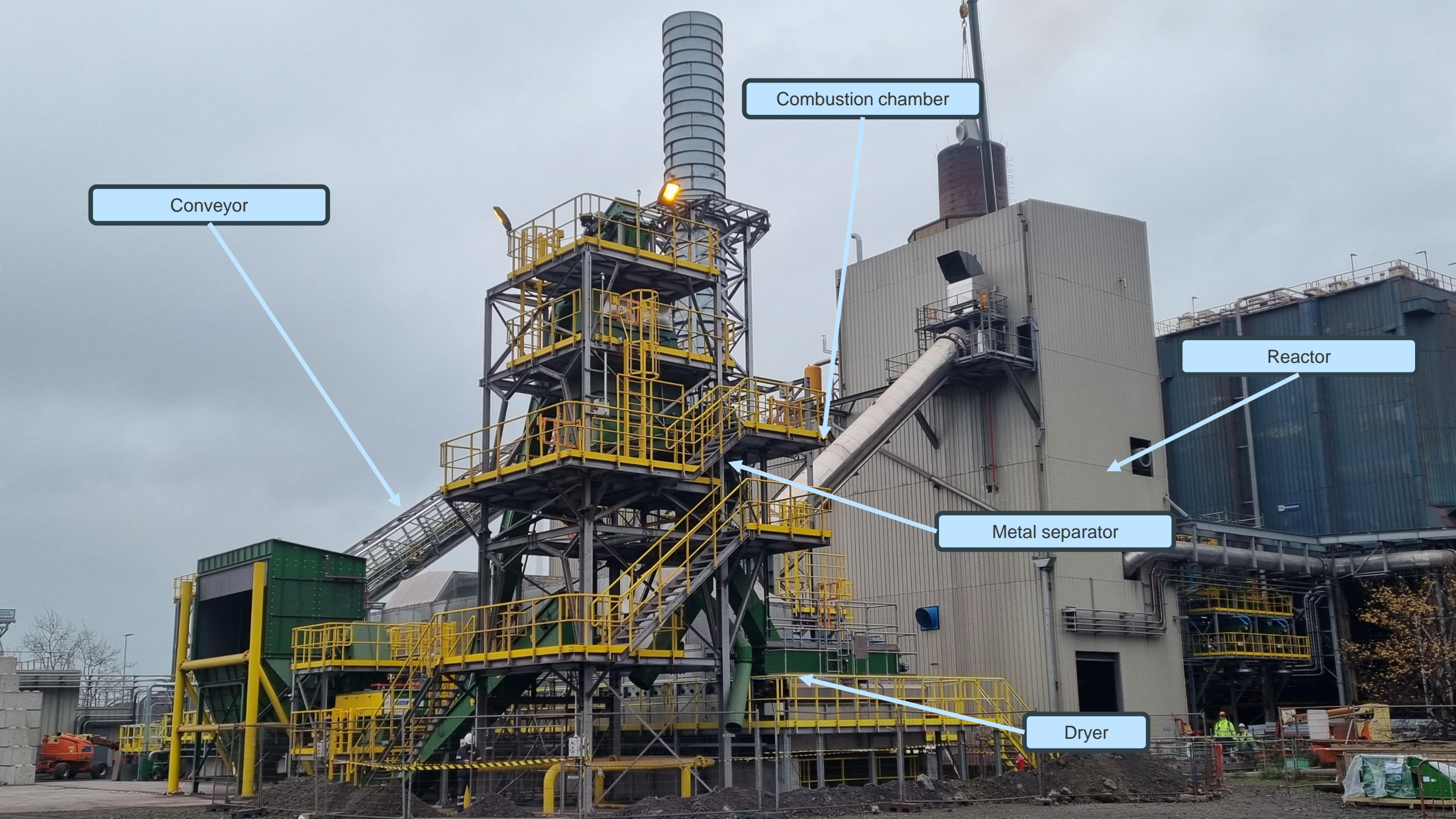


Torero: July 2022



Torero today





Conveyor

Combustion chamber

Reactor

Metal separator

Dryer

**First bio-coal produced in the Torero project in September 2023!**



# Torero milestone achieved in December 2023



ArcelorMittal in Belgium  
flat products



News

Innovation

Your work environment

Your career

Our responsibility

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## Torero officially commissioned

ArcelorMittal commissions a first for the European steel industry to convert waste wood into bio-coal in order to reduce fossil coal consumption at its steel plant in Ghent, Belgium.

- €35 million plant first of its kind in the European steel industry
- Project part of multi-technology strategy to reduce carbon emissions at Ghent plant

### 19 December 2023

ArcelorMittal Belgium is passionate about sustainability and circularity and is playing an absolute pioneering role in the industry when it comes to climate transition. ArcelorMittal strives to produce steel in a socially responsible manner and considers the social impacts along the whole product chain.

ArcelorMittal Belgium is fully engaged in implementing an action plan to reduce CO2 emissions by 35% by 2030 compared to 2018 and to become climate neutral by 2050. Within this framework, ArcelorMittal Belgium commissioned a plant to process waste wood into bio-coal suitable for the blast furnace process, hence lowering the volume of fossil coal used. This project will reduce annual carbon emissions by 112,500 tonnes. The Torero plant will convert 88,000 tonnes of waste wood into 37,500 tonnes of bio-coal each year.



# Carbon capture pilot projects

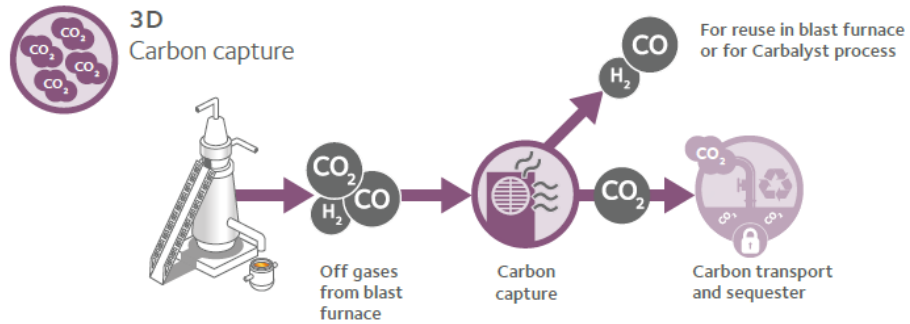


ArcelorMittal



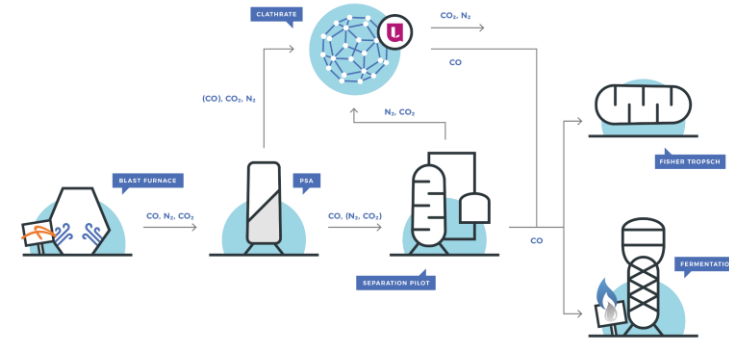
# Carbon Capture pilots

## 3D- Carbon Capture for Storage



## Carbon2Value-Steel2Chemicals

Carbon Capture for Storage and Utilization



- ifp Energies nouvelles
- TotalEnergies
- GreenFlex
- Axens
- ETH zürich
- DTU Danmarks Tekniske Universitet
- AIR PRODUCTS
- John Cockerill
- GASSCO
- BREVIK engineering
- uetikon novacorp group

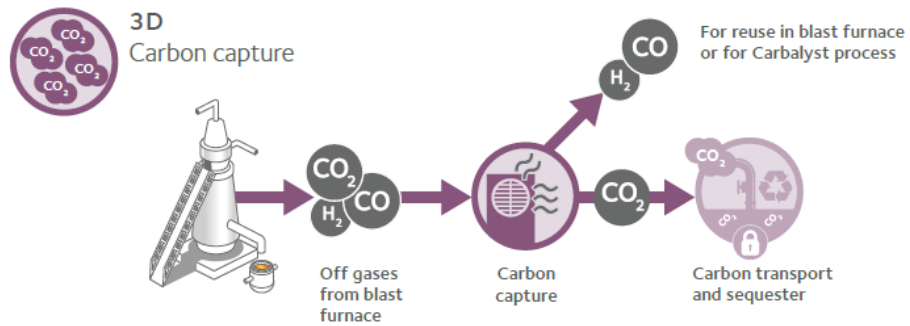
- DOW
- LanzaTech
- POM Provinciale Ontwikkelingsmaatschappij Oost-Vlaanderen
- Université de Lille
- ISPT Institute for Sustainable Process Technology





# Carbon Capture pilots

**MHI pilot**– Carbon Capture for Storage:  
BF gas, hot strip mill reheating furnace and DRI stack gas



MHI-pilot AM Gent



**BHP**

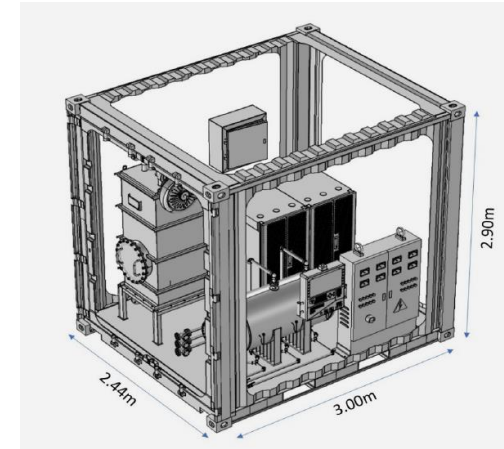


**MITSUBISHI HEAVY INDUSTRIES**

**PRIMETALS TECHNOLOGIES**

**ArcelorMittal**

**D-CRBN pilot**– CO<sub>2</sub> to CO conversion  
–Output of MHI-pilot connected to plasma reactor of D-CRBN



CO<sub>2</sub> recycling in an energy-efficient way using innovative plasma technology in high-value products: CO, syngas, methanol, ...



CO<sub>2</sub>



PLASMA



CO + O



HAPPY BLUE PLANET

**ArcelorMittal**

08 July 2024

## World-first trial of new technology to recycle CO<sub>2</sub> emissions from steel production begins at ArcelorMittal Gent, Belgium

D-CRBN  
CO<sub>2</sub> RECYCLING

CO<sub>2</sub>  
CAPTURE  
SYSTEM

MITSUBISHI  
HEAVY INDUSTRIES

# Thank you



*Steelanol has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 656437.*

*Torero has received funding from the European Union's Horizon 2020 research and Innovation Framework Program. Project ID: 745810.*

*The projects are supported by the Flemish and Belgian government.*



Thank you for your attention !  
Contact: [wim.vanderstricht@arcelormittal.com](mailto:wim.vanderstricht@arcelormittal.com)