Vías de Descarbonización en los Sectores Industriales de España, Grecia, Alemania y Países Bajos

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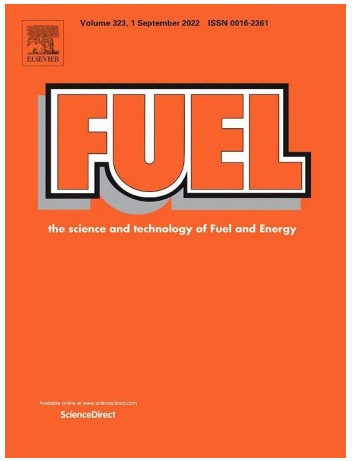
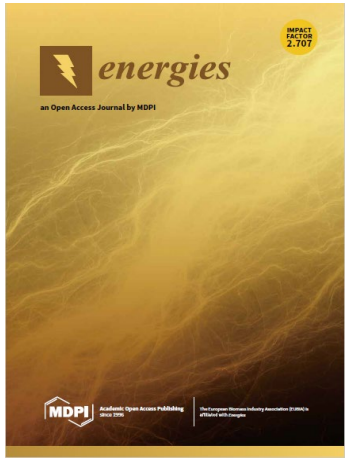
CENTRO TECNOLÓGICO

La presente comunicación sintetiza el contenido de publicaciones recientes:

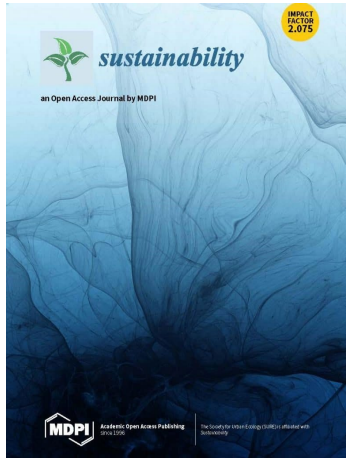


2024: Deep decarbonization of the energy intensive manufacturing industry through the bioconversion of its carbon emissions to fuels

2024: Charting the Course: Navigating Decarbonisation Pathways in Greece, Germany, The Netherlands, and Spain's Industrial Sectors

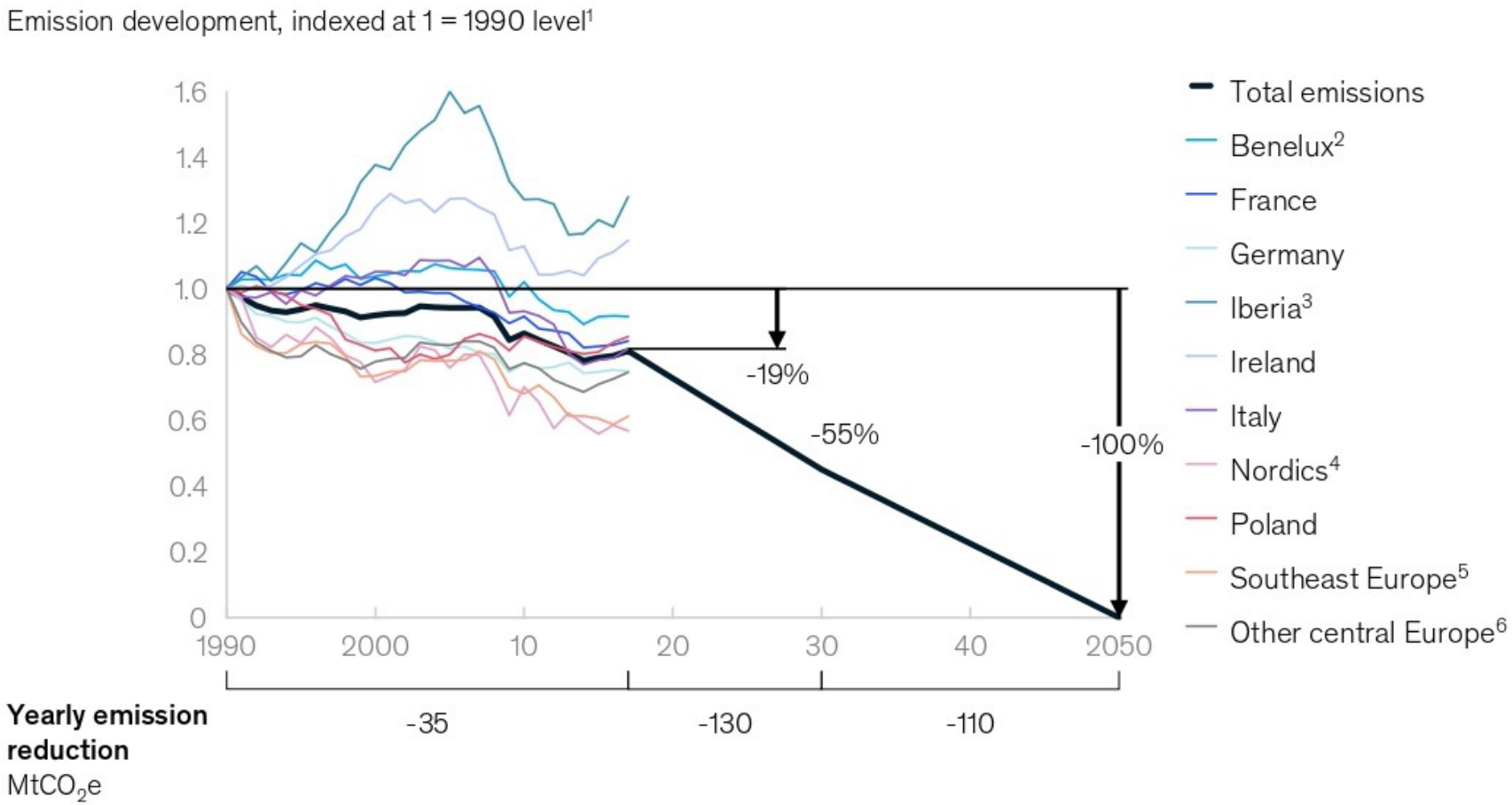


2023: The Role of Biogas and Biomethane as Renewable Gases in the Decarbonization Pathway to Zero Emissions



2022: Renewable power and heat for the decarbonisation of energy-intensive industries

Context: the EU will need to reduce net GHG emissions much faster to meet 2030 and 2050 climate targets



1. Includes impact of land use, land-use change, and forestry (LULUCF) on GHG emissions.
2. Belgium, Luxembourg, Netherlands
3. Spain & Portugal
4. Denmark, Estonia, Finland, Latvia, Lithuania, Sweden
5. Bulgaria, Greece, Romania
6. Austria, Croatia, Czech Republic, Hungary, Slovakia, Slovenia

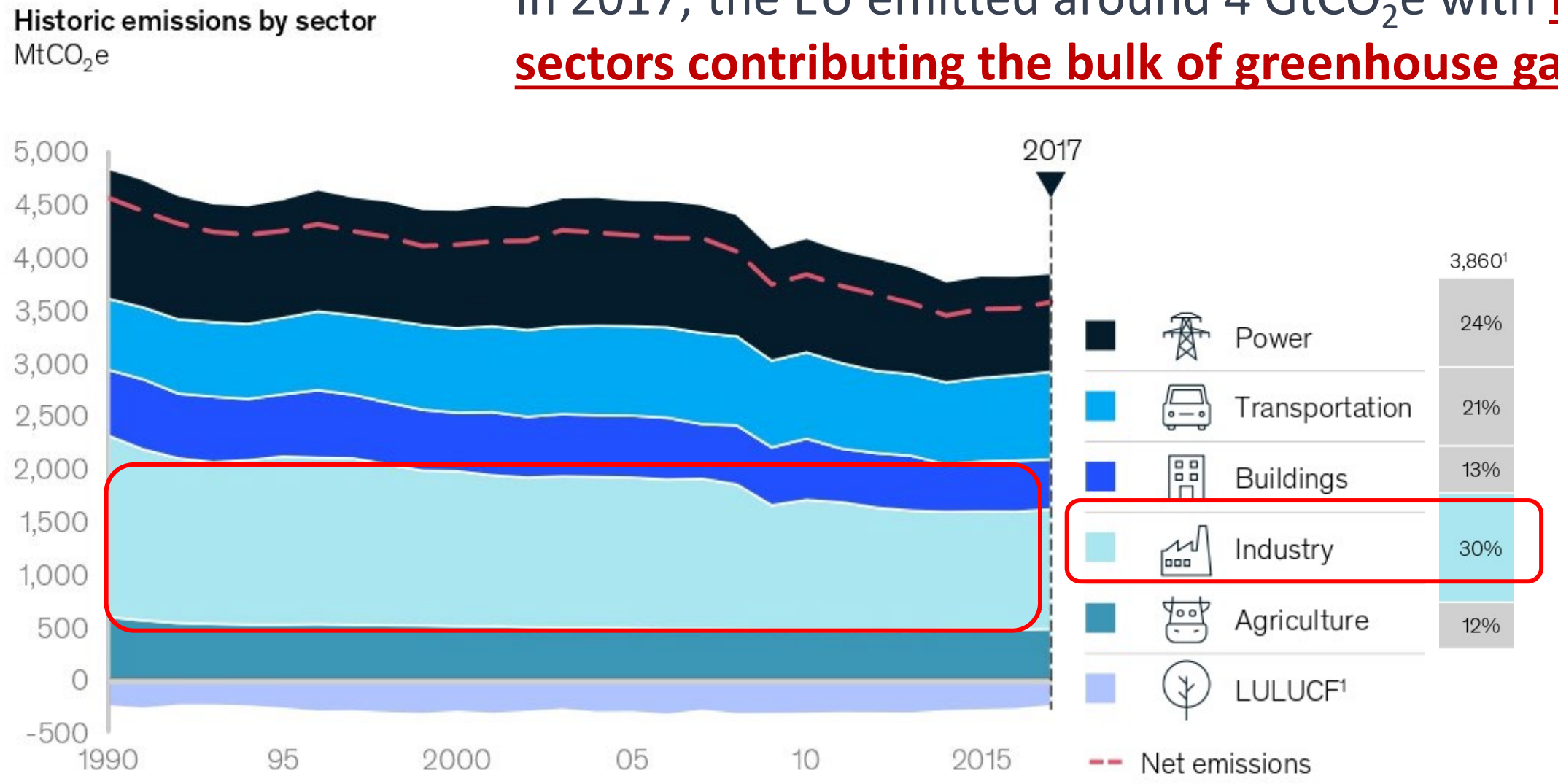
Source: McKinsey, Eurostat, EEA

- **EU Green Deal is an ambitious plan to tackle climate change** announced in Dec 2019
- **The plan aims to achieve net-zero emissions by 2050** with interim targets of a 55% reduction by 2030
- **Fossil fuel combustion accounts for 80% of emissions**, and significant changes in all sectors will be required to meet targets

d'Aprile, P., et al. "How the European Union could achieve net-zero emissions at net-zero cost." McKinsey & Company: Chicago, IL, USA (2020)

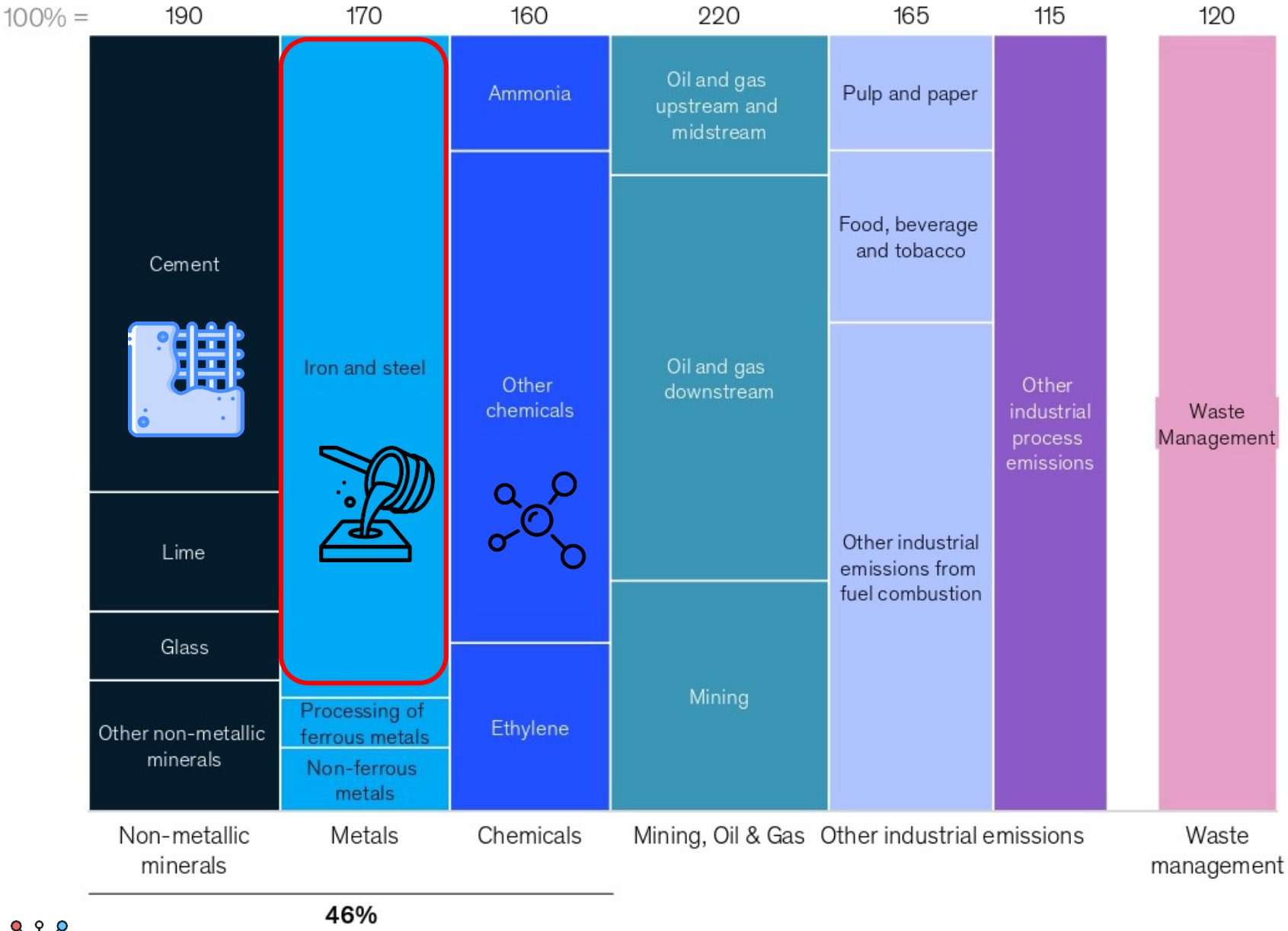
The bulk of Europe's emissions are generated by five sectors

In 2017, the EU emitted around 4 $GtCO_2e$ with **five sectors contributing the bulk of greenhouse gases**



d'Aprile, P., et al. "How the European Union could achieve net-zero emissions at net-zero cost." McKinsey & Company: Chicago, IL, USA (2020)

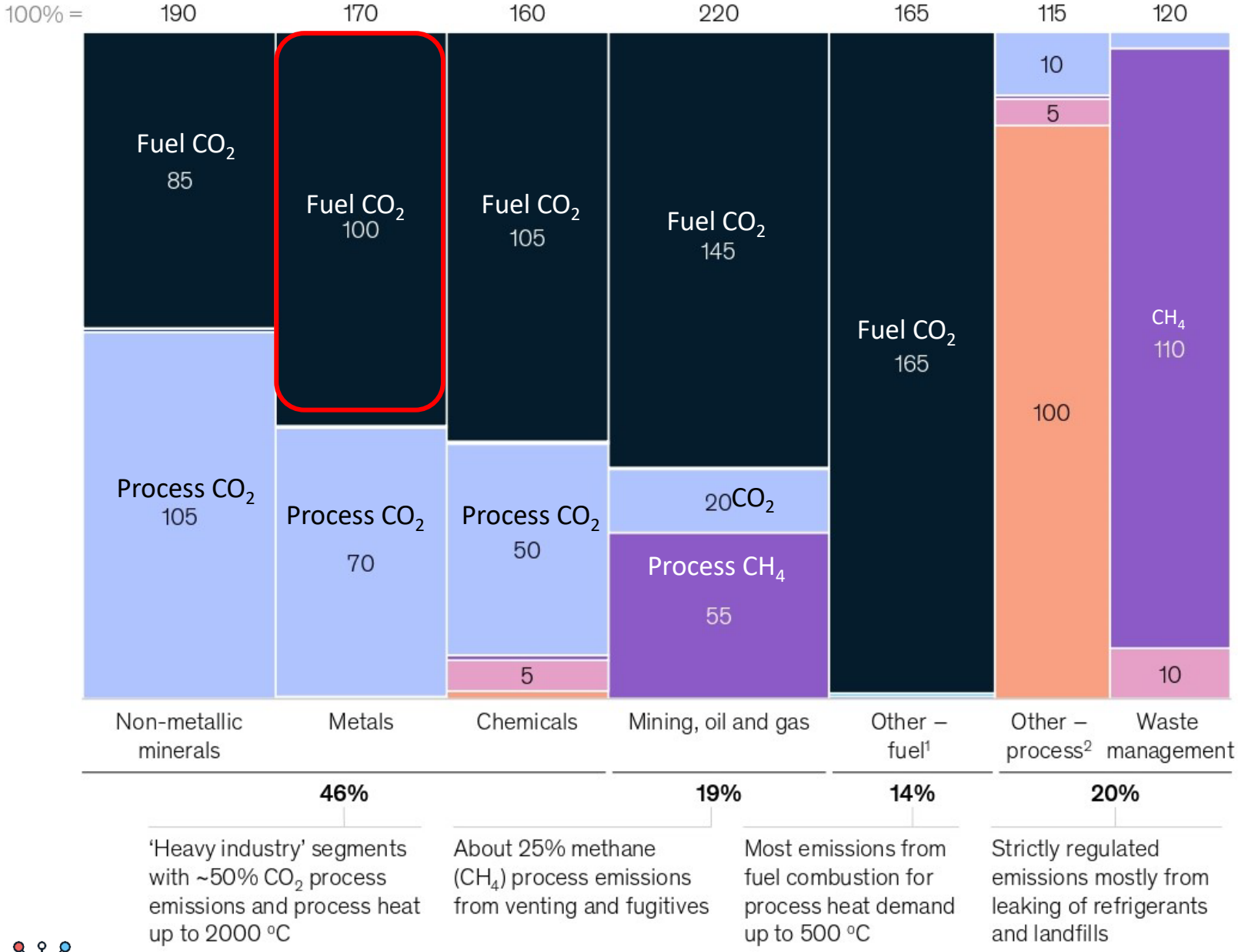
Emission by subsector in $MtCO_2e$, 2017



- Basic products like **cement, glass, steel, and plastics require high temperatures to produce**
- Nearly **half of emissions produced in these segments are CO_2 process emissions**, primarily from heating limestone to make lime for cement production
- These **hard-to-abate emissions pose a significant challenge to achieving emissions reductions in heavy industry**

d'Aprile, P., et al. "How the European Union could achieve net-zero emissions at net-zero cost." McKinsey & Company: Chicago, IL, USA (2020)

Emissions are split between fuel combustion emissions and process emissions



- **Half of industrial emissions come from fuel combustion for process heat**
- Half of industrial emissions come from chemical reactions during feedstock processing
- Process emissions include fugitive GHG emissions like methane leakage from pipelines
- Solutions must target both fuel combustion and process emissions to effectively address industrial emissions

d'Aprile, P., et al. "How the European Union could achieve net-zero emissions at net-zero cost." McKinsey & Company: Chicago, IL, USA (2020)

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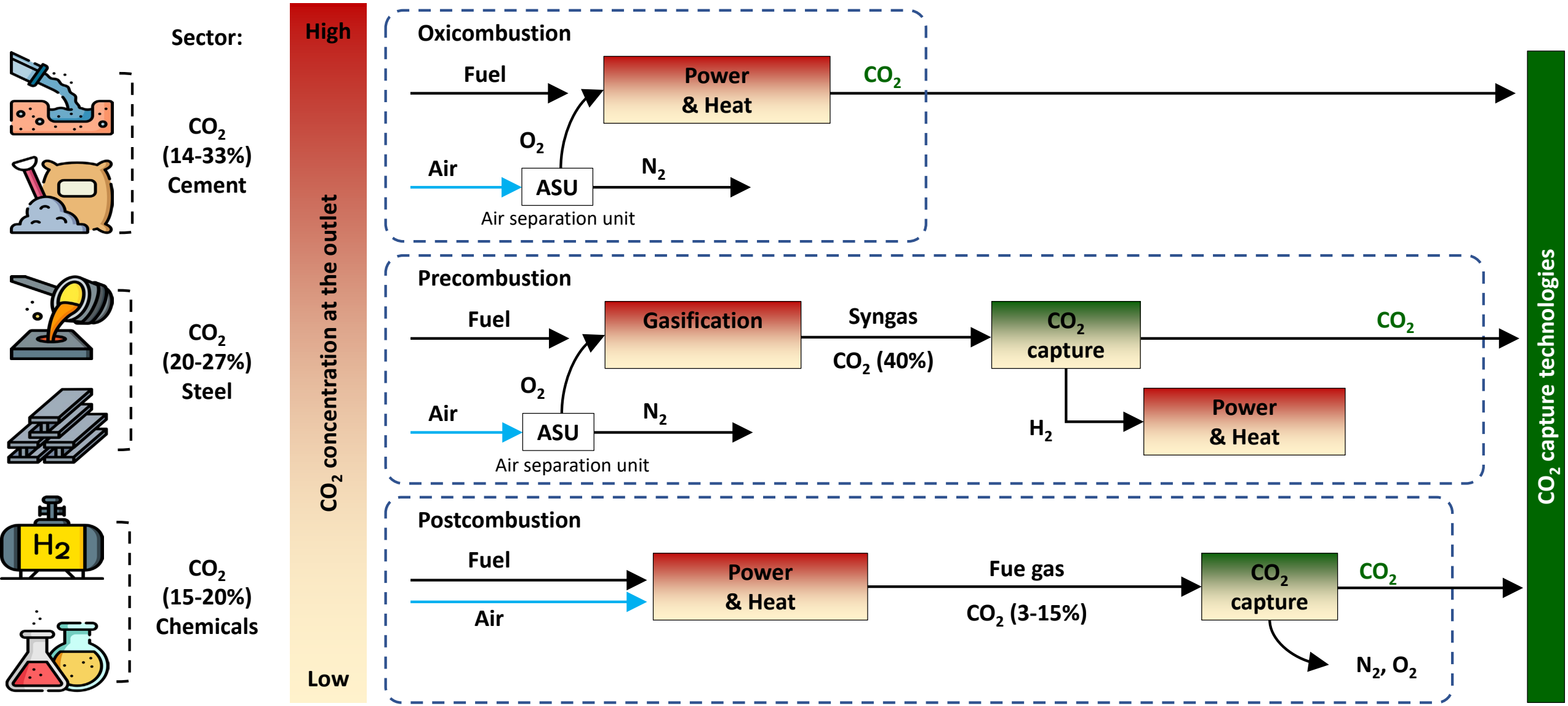
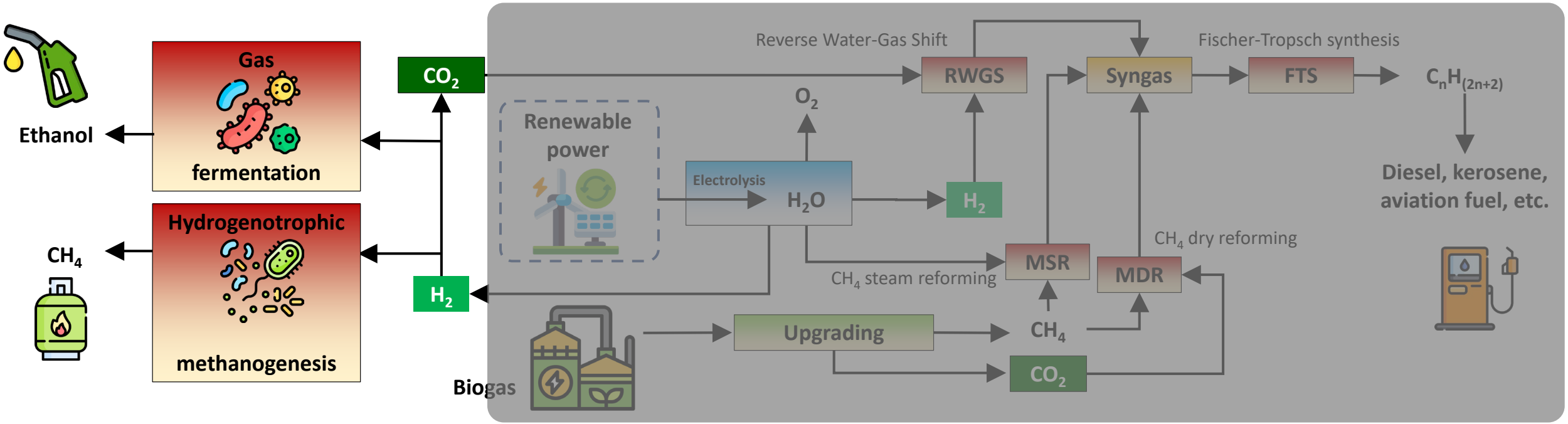
Existing industrial CO_2 sources



Redrawn from: Wang, X., & Song, C. (2020). Carbon capture from flue gas and the atmosphere: A perspective. Frontiers in Energy Research.

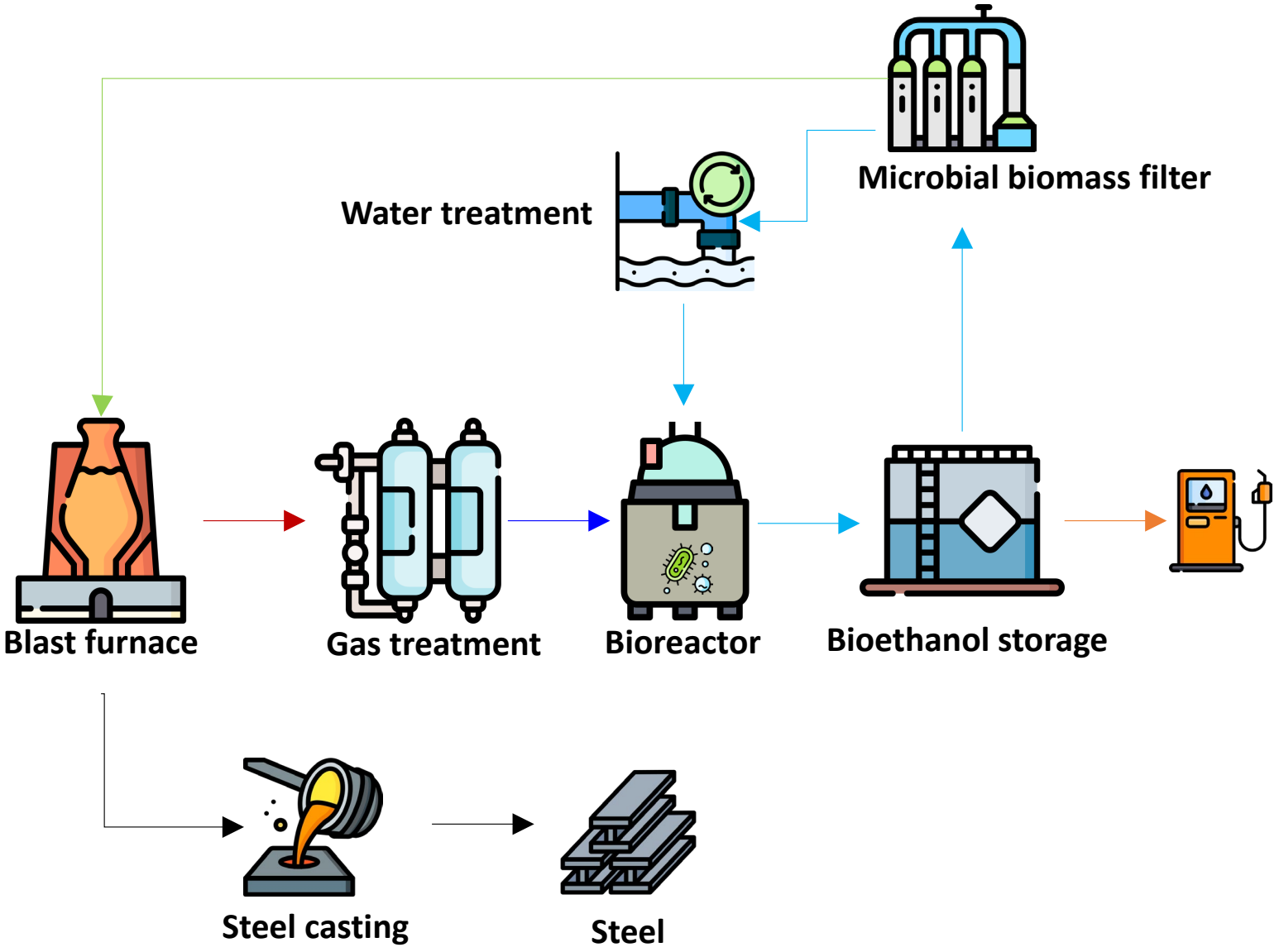
Pathways for CO_2 bioconversion into fuels



"continuous gas fermentation operates at low temperature and low pressure, is feedstock flexible, and has shown high tolerance to gas contaminants while maintaining high product selectivity"

Fackler, Nick, et al. Annual review of chemical and biomolecular engineering (2021)

Industrialisation of CO_2 bioconversion into fuels



- **CO_2 bioconversion into fuels is possible**, as demonstrated by examples such as the Steelanol project within the steel sector
- The Steelanol project operates a plant in Ghent, Belgium, with the goal of **producing 80 million liters of bioethanol**
- The bioethanol produced by the Steelanol plant will be used as a **low carbon alternative fuel in the transport sector**
- This decarbonization initiative has received funding from various sources, including the EU, and is expected to **prevent the emission of approximately 130k tonnes of CO_2 per year**

Drawing based on the scheme by: Perathoner, et al. "Reuse of CO_2 in energy intensive process industries." Chemical Communications (2021)

The Steelanol project

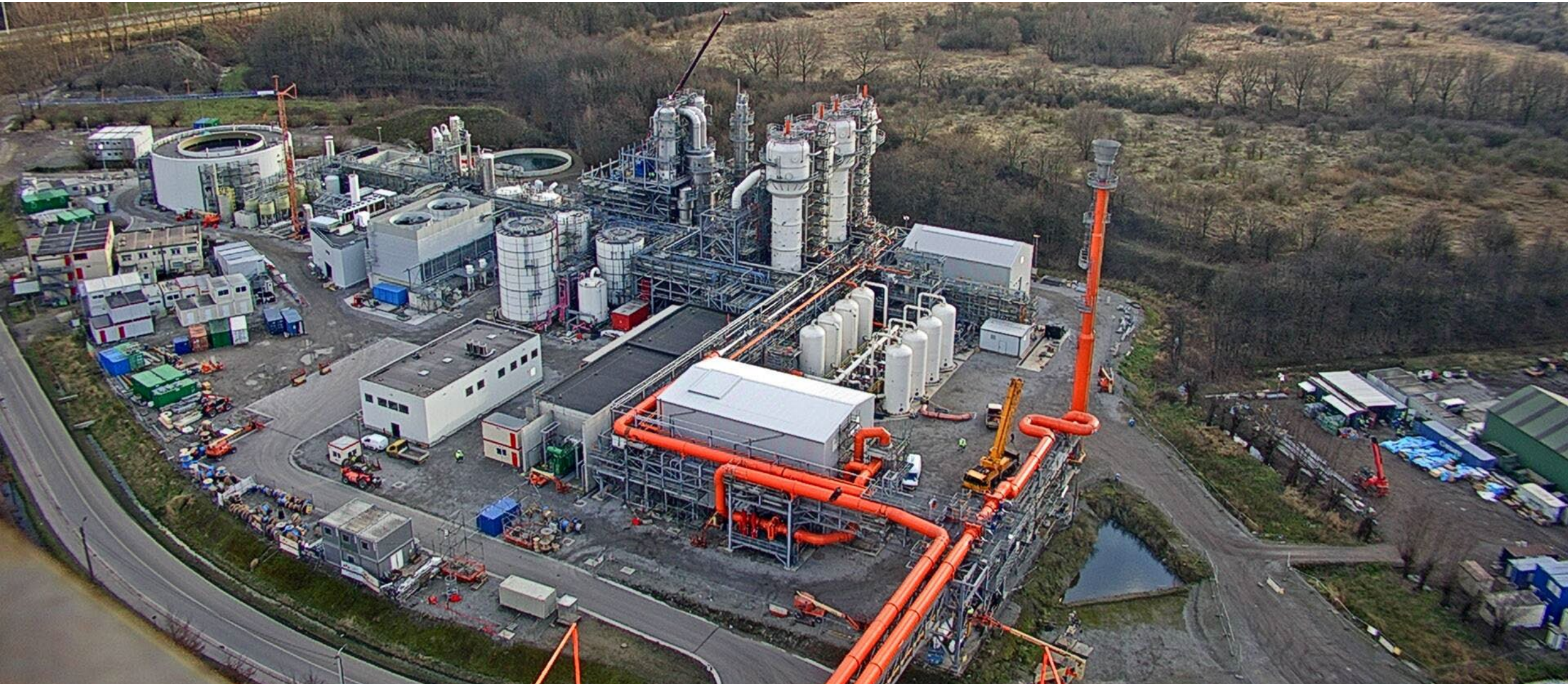
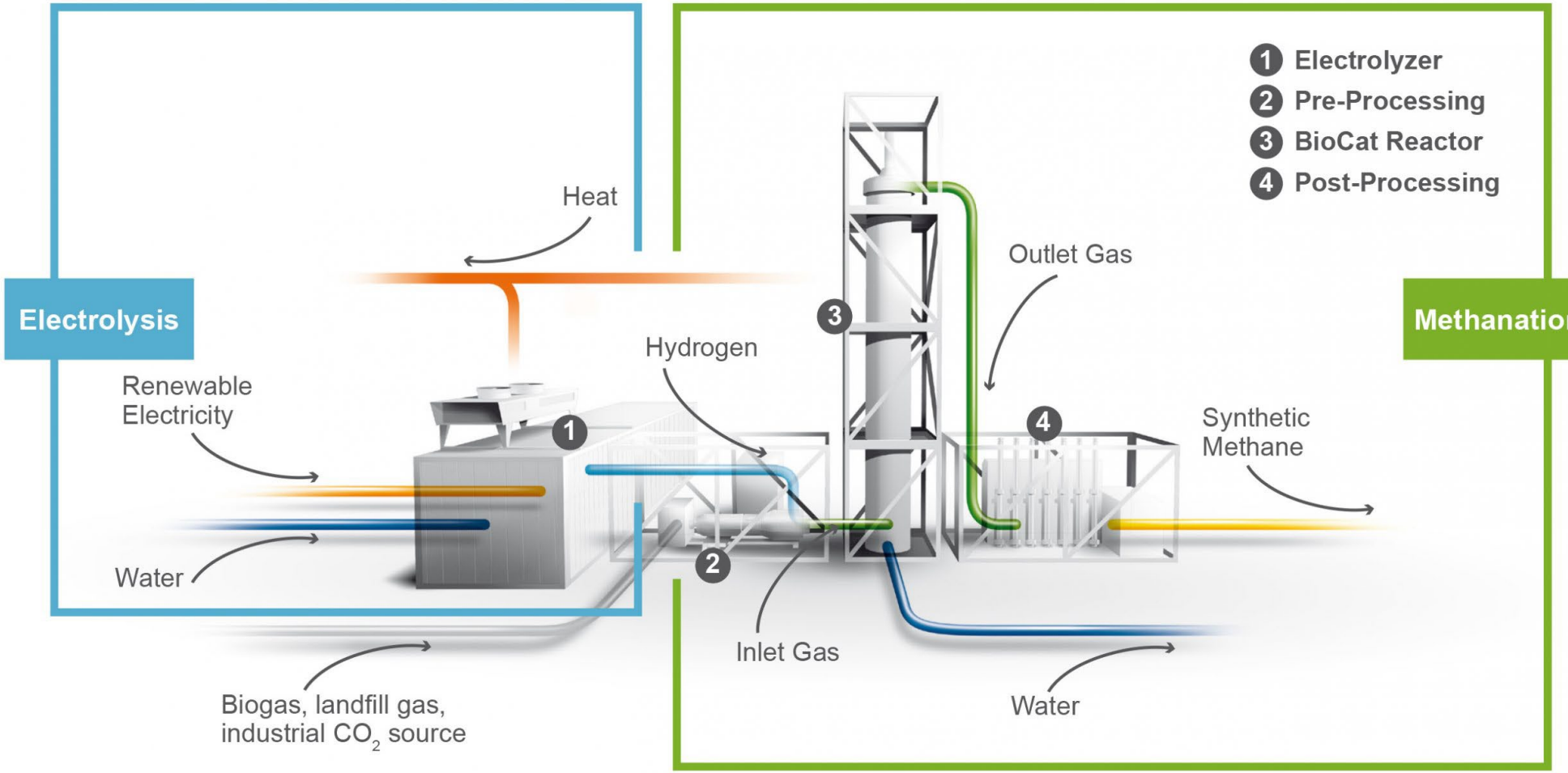
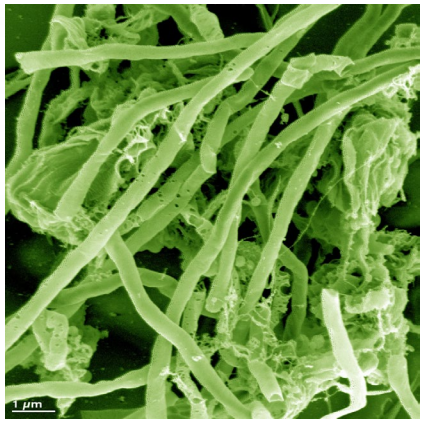


Photo: SmartCarbon Technologies at ArcelorMittal. MUSIC Workshop: Prospects of biocoal for the metallurgical industry. February the 15th, 2023.

Methanation system by Electrochaea





Source: https://www.electrochaea.com/

Issues to be solved by research and concluding remarks

CO_2 utilization through diverse microorganisms and genetic engineering **holds promise for sustainable production of bio-based products**, offering **an alternative to fossil fuel-based industries**

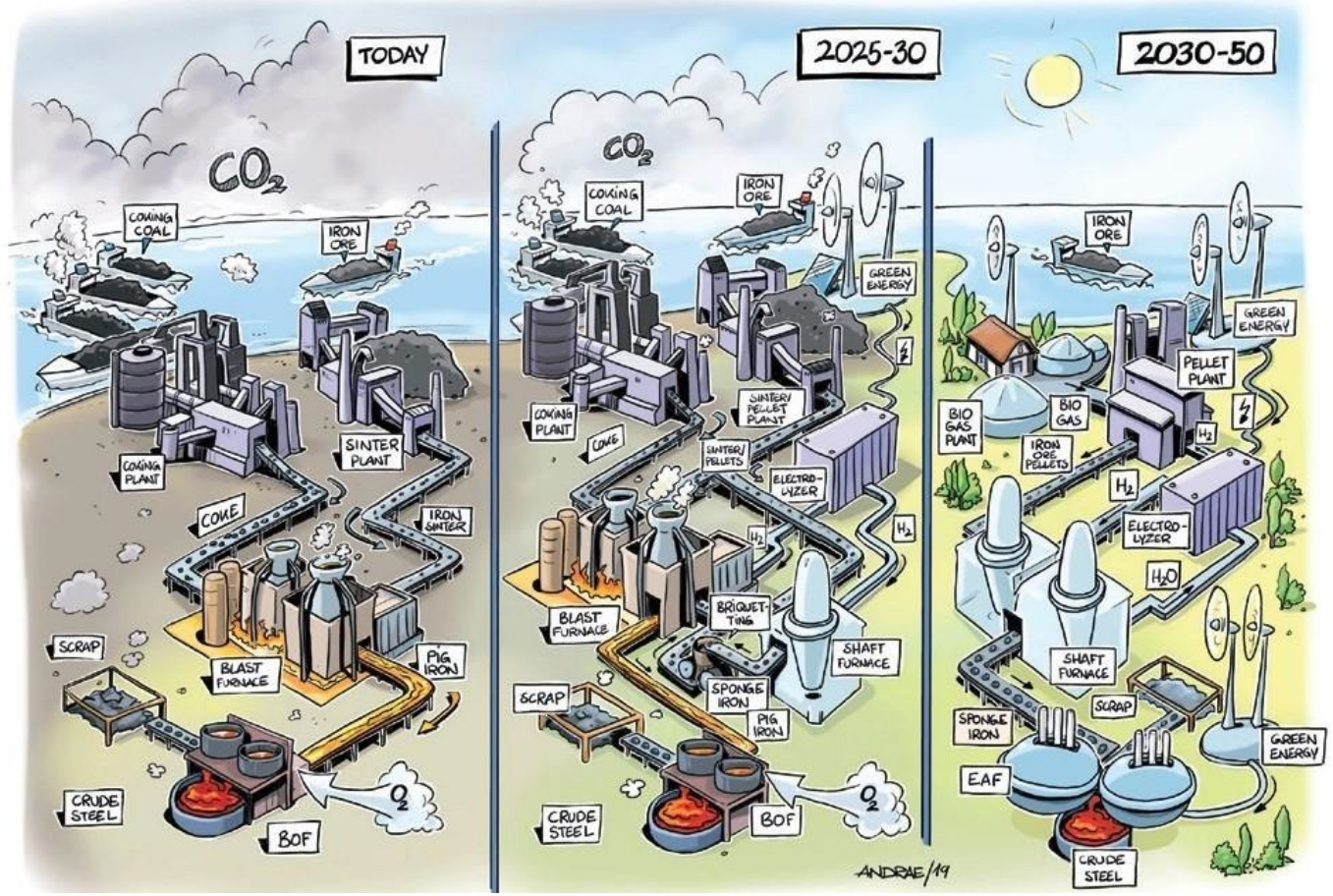
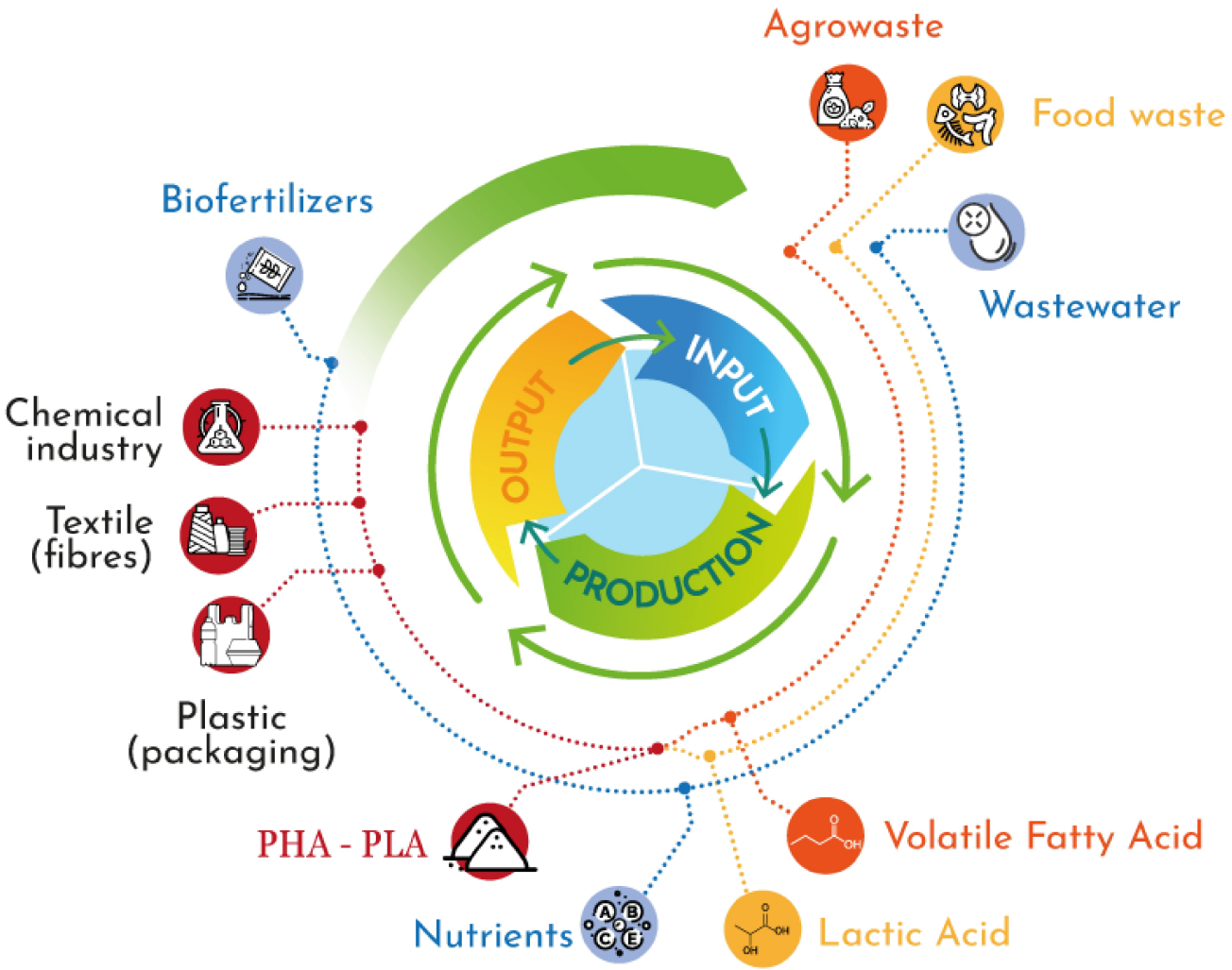


Image caption: “From a brownfield steel plant into a green steel plant based on renewables”.

SYMBA PILOTS



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Thanks for your attention…
Any questions?

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