

# Biomass for high-temperature heat and other industrial applications



The RE4Industry project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952936.

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**Invited Speaker**

**MANOLIS KARAMPINIS**  
Business Development &  
Membership Director,  
Bioenergy Europe



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# MODERN RENEWABLE HEAT USING BIOMASS FOR INDUSTRIES

# About Bioenergy Europe



**Common voice** of the European bioenergy sector since 1990



Unites more than **40 national associations** and around **140 companies** from all steps of the bioenergy value chains



Hosting the **European Pellet Council (EPC)**



Quality & Sustainability **Certifications**

**Bioenergy**  
EUROPE

## Our Services:



**EU Policy Monitoring & Influence**



**Market Data**



**Visibility**



**Networking**



**Free & Discounted Events**

# Our Working Groups

## Members Only

### Pellets

Main topics: updates on European and global pellet markets (residential, commercial, industrial); pelletization technologies; agropellets and advanced pellets; communication and promotion of pellet usage

### Competitiveness

Main topics: policy files affecting the competitiveness of bioenergy sector within the EU (e.g. carbon tax, state aid, RePowerEU, Net Zero Industry Act, etc.)

### Agro-biomass

Main topics: markets and emerging initiatives for the use of agricultural residues, agro-industrial residues and energy crops; interconnections between agriculture & energy policy files

### Sustainability

Main topics: EU legislation impacting the sustainable mobilization of biomass feedstocks for energy production, e.g. RED II, RED III, Taxonomy, etc.

### Wood Supply

Main topics: markets for wood fuels (e.g. wood chips, sawdust, firewood, etc.); market and policy factors affecting wood supply; forest management & interaction with wood fuels markets

### Domestic Heating

Main topics: policy files related to biomass use for the domestic heating sector, such as building regulations, air emissions, Ecodesign and Ecolabelling regulations for biomass stove & boilers

### Carbon Dioxide Removals

Main topics: policy files regarding negative emissions (e.g. carbon removals certification framework); technologies and projects for carbon removals from biomass (e.g. BECCS and biochar)

### Task Force National Advocacy

Scope: enhance cooperation between Bioenergy Europe and National biomass associations for more effective advocacy on EU and national levels

### Task Force Communications

Scope: share experiences and coordinate efforts on issues related to bioenergy communication for policy makers, stakeholders and the general public

# Two EU H2020 projects addressing bioenergy use by Energy Intensive Industries



- Increased renewable energy use in the European Energy Intensive Industries (EII) sector.
- Website: <https://re4industry.eu/>
- Duration: Sep 2020 – Aug 2023



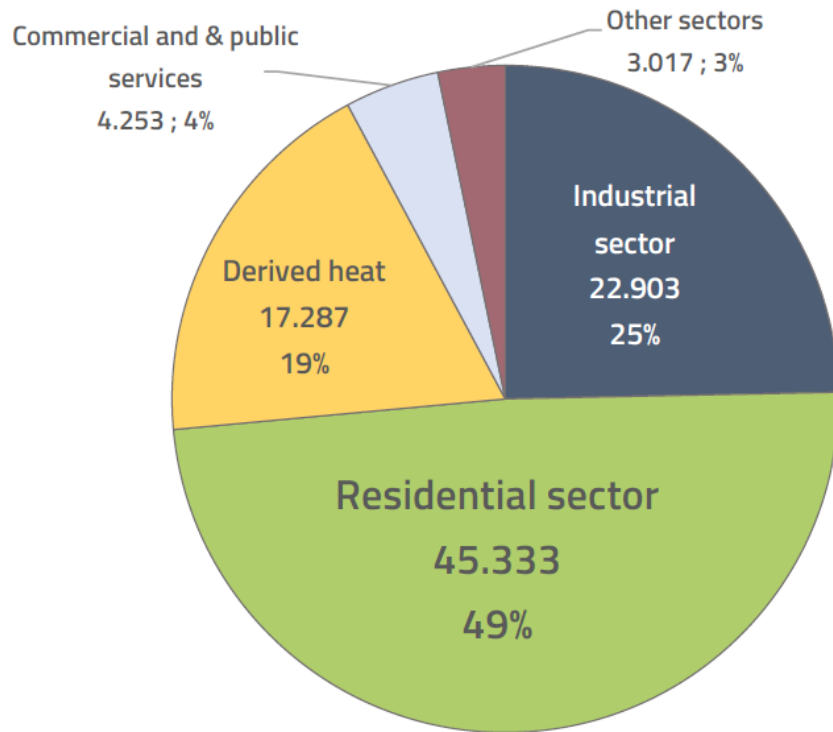
- Focus on Intermediate Bioenergy Carriers (IBCs): torrefied biomass, fast pyrolysis bio-oil, microbial oil.
- Website: <https://www.music-h2020.eu/>
- Duration: Sep 2019 – Feb 2023



The RE4Industry and MUSIC projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No 952936 and 857806 respectively.

# Bioheat consumption in the EU industry

Total bioheat consumption in different sectors for EU27 in 2021 (in ktoe)



Final energy consumption for process heat in industry by energy carrier and temperature level for EU28 in 2012

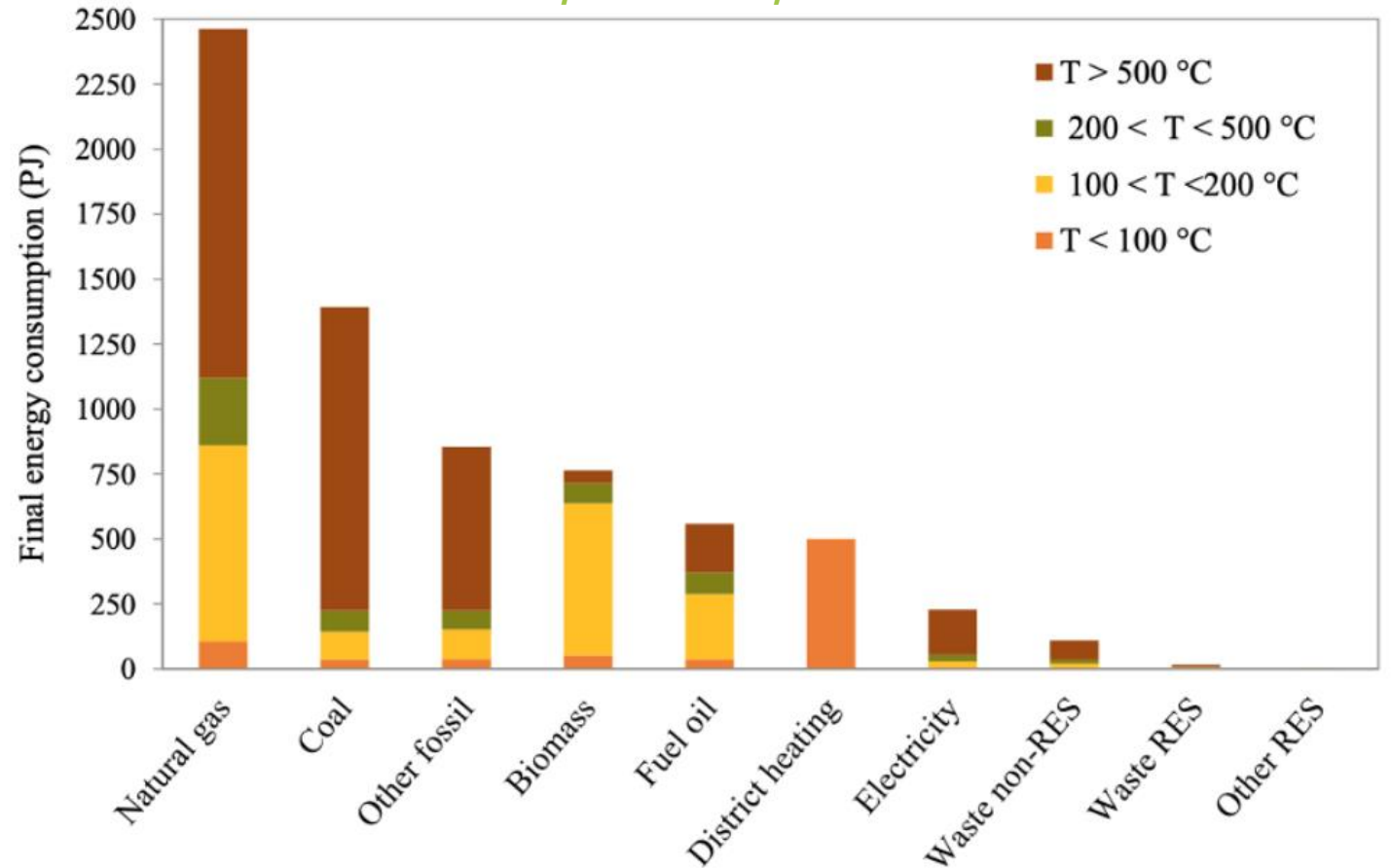
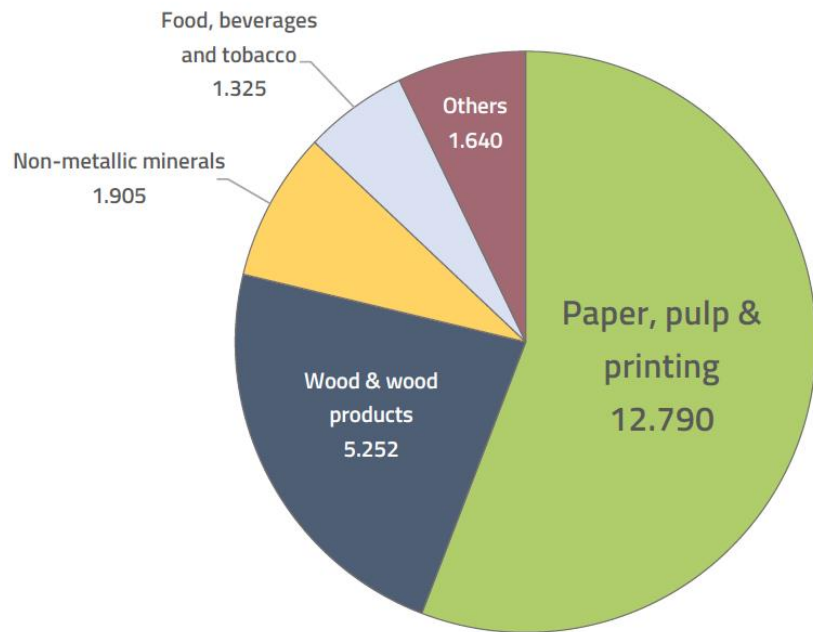


Image Sources:  
 Left - Bioenergy Europe, Bioheat Statistical Report 2023, Eurostat data  
 Right - Malico et al. (2019). Current status and future perspectives for energy production from solid biomass in the European industry. Renewable and Sustainable Energy Reviews, 112. 960-77.



# Bioenergy in the EU industrial energy consumption

Share of biomass usage in the different industries in EU27 in 2021 (in ktoe - %)



Energy demand by industry and share of bioenergy for sectors dealing with biomass wastes and residues and for other sectors in EU27 in 2021 (ktoe)

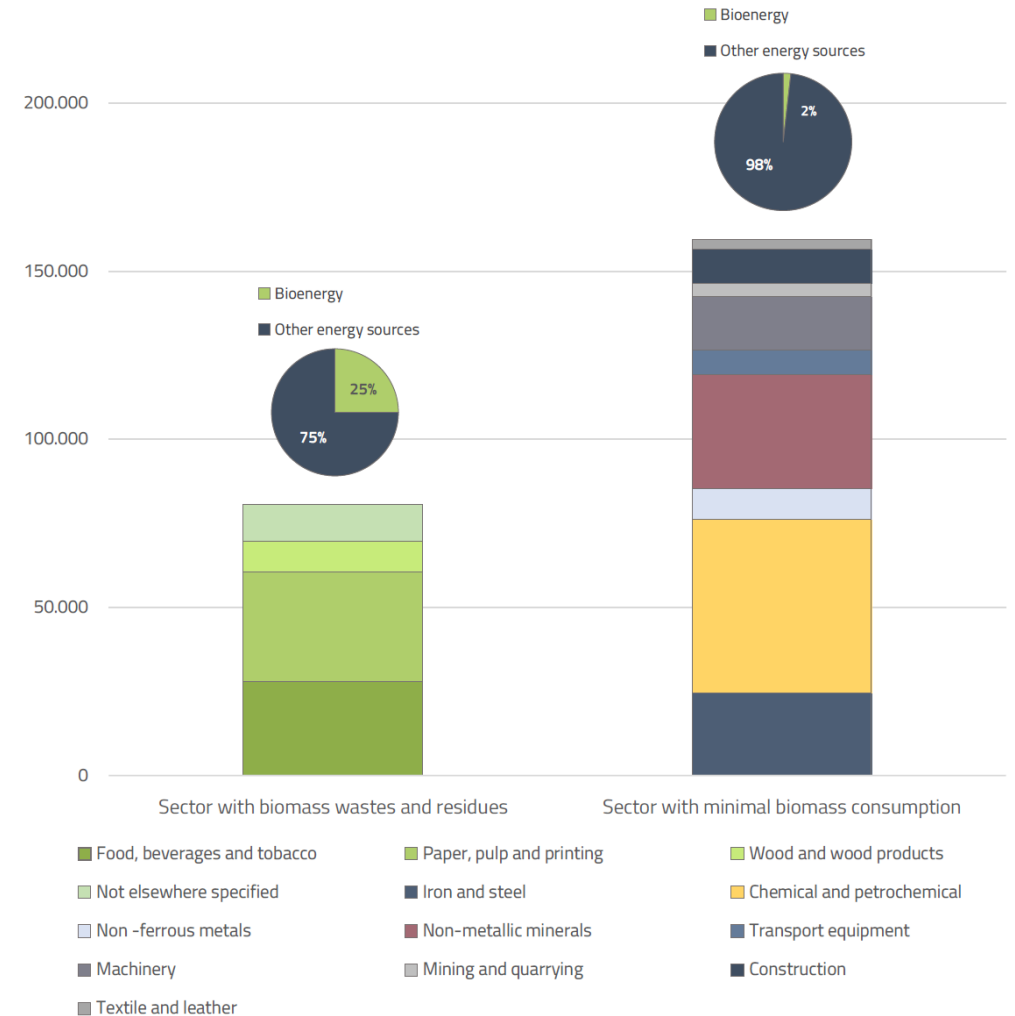
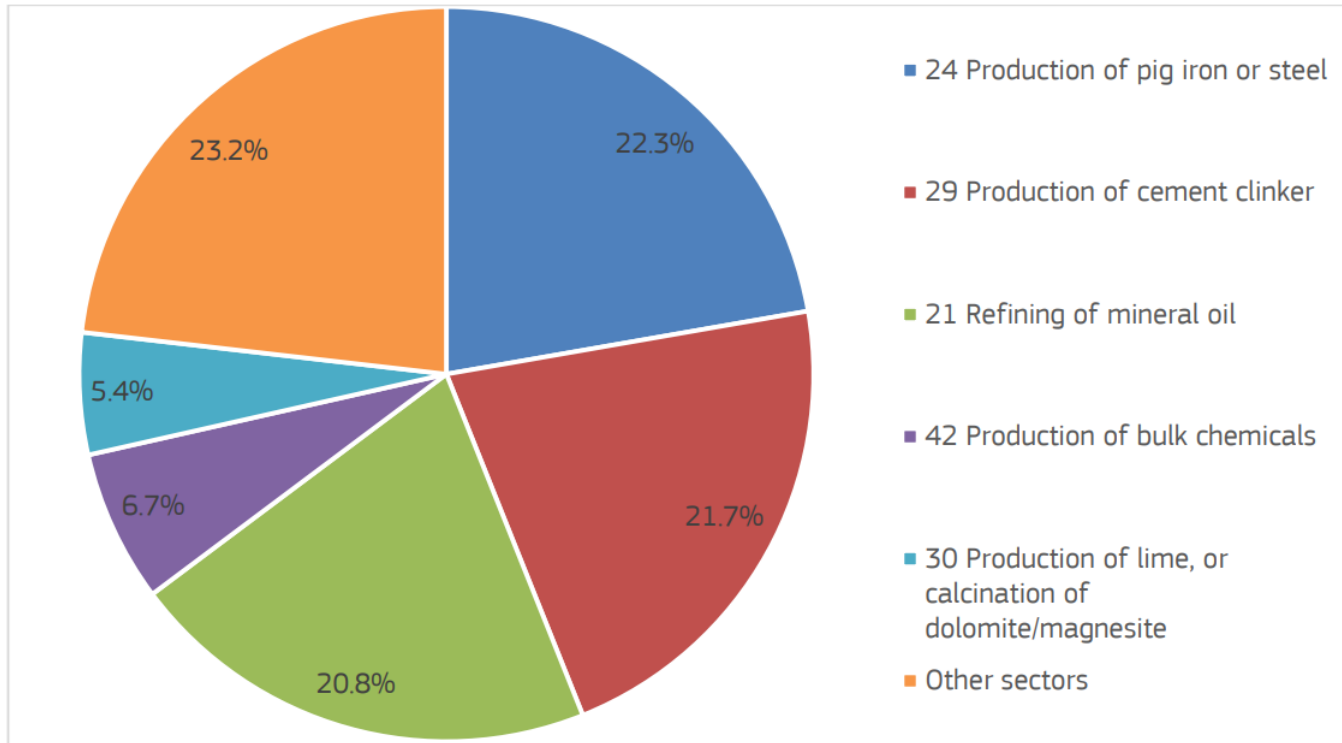


Image Sources: Bioenergy Europe, Bioheat Statistical Report 2023, Eurostat data

# GHG emissions from EU industry

Share (%) of verified emissions in EU27 industry sectors in t CO2 equivalent reported under ETS, 2021



Source: JRC based on [EEA, 2022]

Estimated direct emissions of industry in Europe by end use and sub-sector

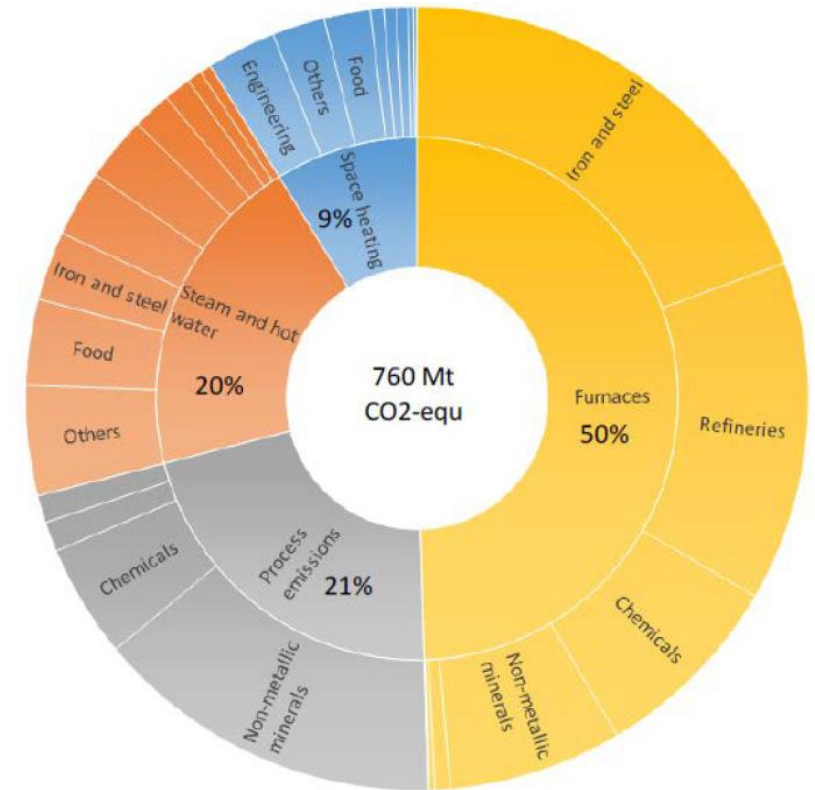


Image Sources:

Left - Marmier, A., Decarbonisation options for the cement industry, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/174037, JRC131246

Right – de Bruyn et al., S, Energy-intensive industries – Challenges and opportunities in energy transition, study for the committee on Industry, Research and Energy (ITRE), Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2020

# Bioenergy and the cement industry

- Average thermal energy consumption: 3,733 MJ/t clinker; temperatures up to 1,450 °C
- EU cement production: 183 Mt (2022), 73.7% clinker
- 60 - 65 % of CO<sub>2</sub> emissions are (unavoidable) process emissions
- A few individual cement plants may go to almost 100 % thermal energy substitution by alternative fuels
- Cement plants typically use low/negative value biomass feedstocks: animal meal, sewage sludge, waste wood / green waste
- As of early 2022, 15 Mt of cement production with carbon capture use or storage) have been announced



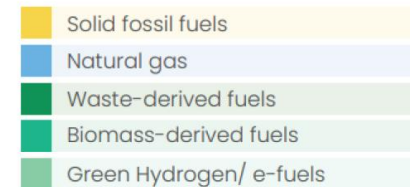
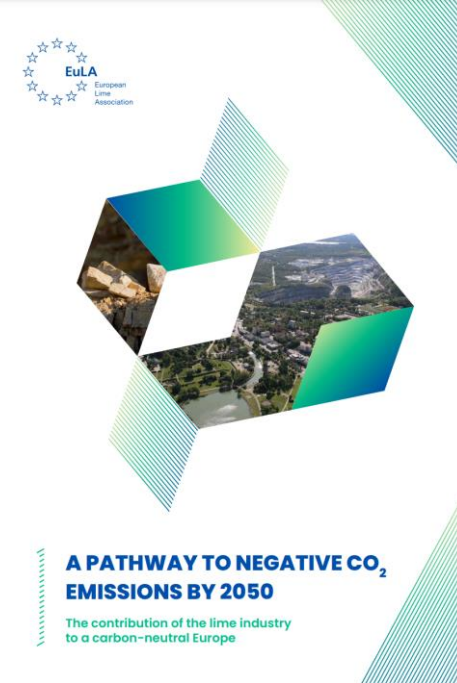
Fuels in EU cement industry	2018	2030	2050
Alternative fuels – total	48 %	60 %	90 %
Biomass waste fuels	17 %	30 %	> 50 %

Sources: CEMBUREAU, Material Economics (2022) Scaling up Europe  
 Images: HERACLES / Holcim Milaki Cement Plant (Greece) – RE4Industry case study



# Bioenergy and the lime industry

- Average thermal energy consumption: 4,250 MJ/t quicklime; temperature level of around 900 – 1,200 °C
- EU quicklime production: 22 Mt (2021); > 470 lime kilns in almost all EU countries; generally small-sized companies, with some exceptions
- 69 % of CO<sub>2</sub> emissions are (unavoidable) process emissions
- Biomass around 2 % of fuel consumption in EU lime industry (2012) – higher for some lime plants that are pioneers in the use of locally available biomass resources (e.g. olive cake, wood chips, etc.)
- According to EuLA, fuel switching is a key component in the EU lime sector decarbonization strategy → **biomass around 1/3 of the fuel mix** → **estimated at around 2 Mt/y**



Sources: EuLA (2023) A pathway to Negative CO<sub>2</sub> emissions by 2050, [RE4Industry H2020 project](#)

# Bioenergy and the magnesia industry

- Average thermal energy consumption: up to 10,250 MJ/t of calcined products; very high temperatures – around 2,000 °C to produce Dead Burned Magnesia (DBM)
- EU magnesite production: 2.4 Mt (2022), concentrated in a few plants in Austria, Greece, Spain and Slovakia
- 70 % of CO<sub>2</sub> emissions are (unavoidable) process emissions
- Up to 2016, no biomass use reported by the sector; at least one major initiative (in Greece) has emerged since
- Level of achievable biomass fuel switch depends on the temperature level for each product
- Sector targets 10 – 30 % biomass use as part of its emission reduction roadmap



Sources: Euromines (2022) The European Magnesite/Magnesia Industry: enabler in the transition to a low-carbon economy, [BAMBOO H2020 project](#), Statista  
Image: Grecian Magnesite / Gerakini plant



# Bioenergy / biomass and the steel / metallurgical sector

- Around 58 Mt of fossil carbon used by EU steel industry (2021) as redundant (and heat source)
- Fossil carbon use higher in Blast Furnace (BF) > Direct Iron Reduction (DRI)
- Substitution of fossil carbon by thermally processed biomass is under investigation and pilot projects are implemented
  - Charcoal to replace coke; in principle up to 100 % but only in smaller furnaces due to mechanical properties
  - Biochar or torrefied biomass to replace Pulverized Coal Injection (PCI) in; easier pathway up to a certain level of substitution
- **Potential demand by 2050: 10 – 17 Mt biocoal → 60 – 90 Mt of biomass**
- Other metallurgical industries (i.e. manganese alloys) are also looking into thermally processed biomass fractions as a replacement of fossil carbon



Images: ArcelorMittal – the TORERO & Steelanol projects in the Ghent Steel mill,  
Sources: [MUSIC H2020 project](#), Tata Steel presentation at European Bioenergy Future 2023 conference

Bioenergy Europe members in the steel sector:



# Bioenergy / biomass and the chemical industry

## Chemical industry – Energy

- Substituting fossil fuels used for steam production with biomass is a low-hanging fruit for decarbonizing the energy consumption of chemical industries



## Chemical industry – Renewable chemicals

- Interest in wood as feedstock for biorefineries, producing various renewable intermediate biochemicals for further use in production of cleaning agents, deicing fluids, fragrances, cosmetics, etc.



Images: Solvay Rheinberger plant (left); UPM biorefinery in Leuna, Germany (right)



# Outlook

- Several scenarios foresee an **increasing role of biomass / bioenergy in hard-to-abate sectors, including industrial heat, demand by 2050**
- Biomass / bioenergy is (usually) not the only option for the defossilisation of industrial heat demand: green hydrogen, electrification, CCS/U are also expected to play a role
- Bioenergy is well established in wood & food processing; although currently used in small volumes **biomass / bioenergy leads the race in maturity and cost-effectiveness for hard-to-abate industrial heat applications**; in the long-run it will be employed in applications where it provides a **competitive advantage**
- Prospects for industrial bioheat depend on **market developments** (e.g. fossil fuel and EU-ETS prices vs. biomass), on the **specificities of each industrial site** (e.g. space limitations, local biomass resources, logistics infrastructure and sourcing options), **processes employed** (e.g. chemistry interactions, temperature levels) and other factors
- In all cases, **an enabling policy framework for biomass / bioenergy** is key to unlock the potential

# Thank You!

