

# Biomass in energy intensive industries

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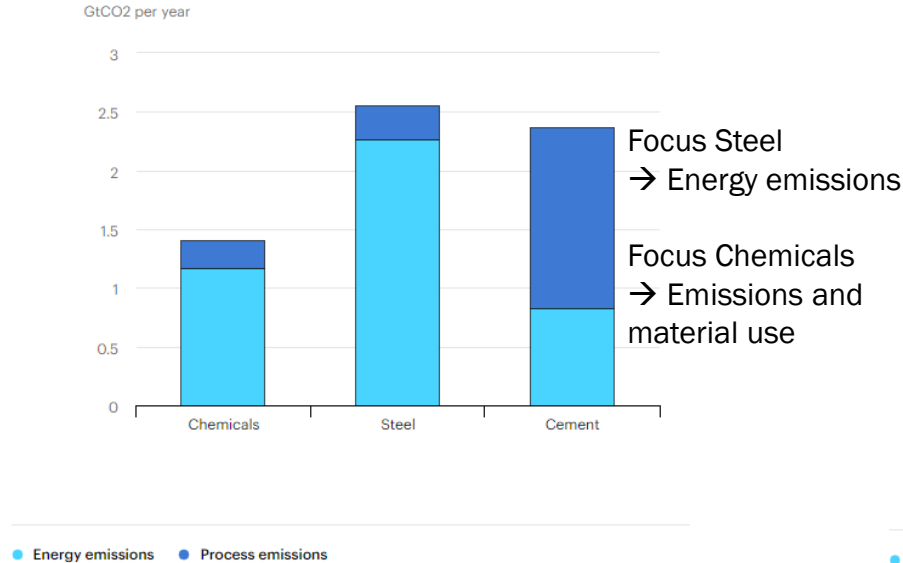
<sup>1</sup> Head of Bioenergy Systems Department at DBFZ, <sup>2</sup> Student assistant in working group resource mobilisation



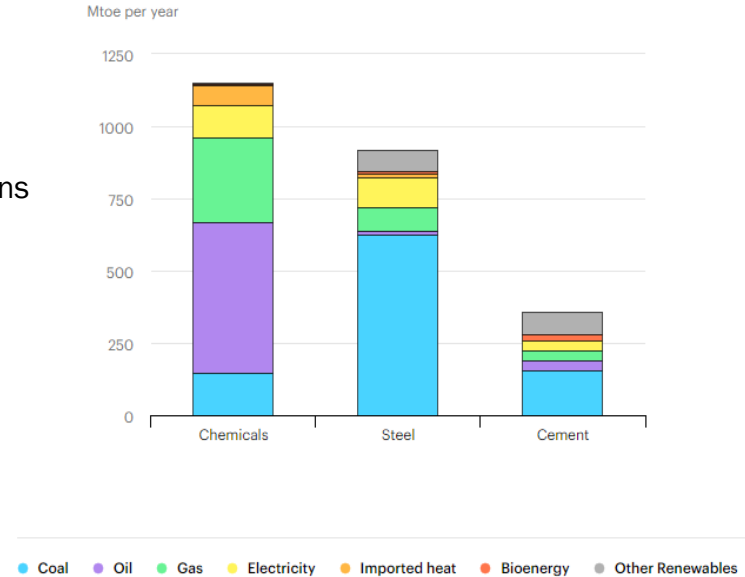
Workshop on "Bio-economy in a net-zero European industry"  
at networking event at DBFZ in Leipzig, 30.-31.05.2022, Day 2

# Energy Intensive Industries: Overview

Final energy demand of selected heavy industry sectors by direct emissions, 2019



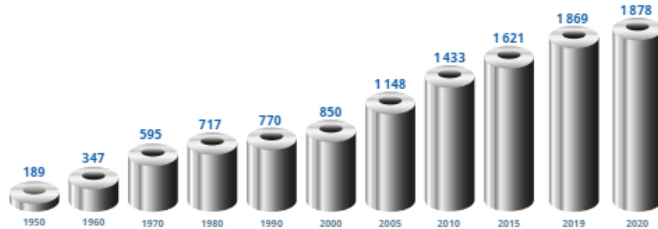
Final energy demand of selected heavy industry sectors by fuel, 2019



Source: <https://www.iea.org/data-and-statistics/charts/direct-co2-intensity-in-iron-and-steel-2000-2018>

# Steel: Overview

World crude steel production 1950 to 2020 (million tonnes)



## Global Emissions

2019: approx. 3.6 Gt CO<sub>2</sub>

→ the global steel industry accounted for ~11% of total global CO<sub>2</sub> emissions in 2019

Top 20 steel-producing countries 2020 (million tonnes)



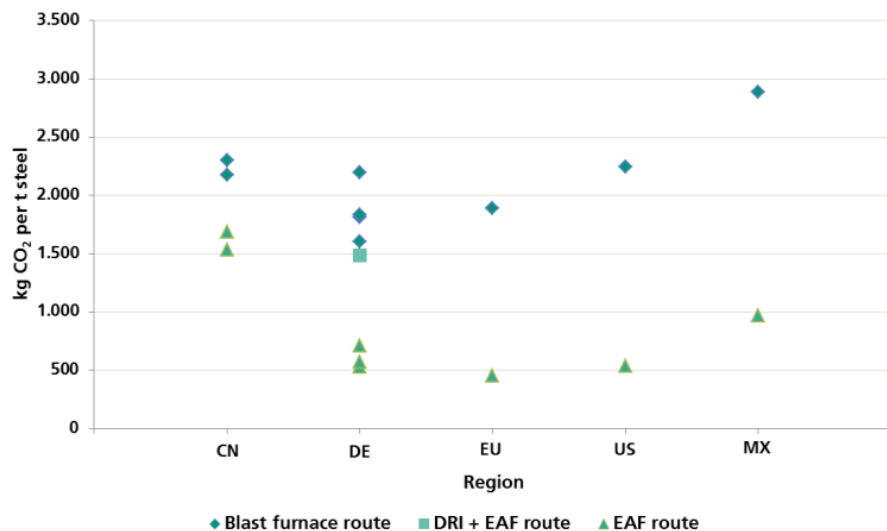
## European Emissions

- Europe accounts for 16% of world crude steel production
- Europe has the lowest emissions per tonne of steel but is not the largest producers of either

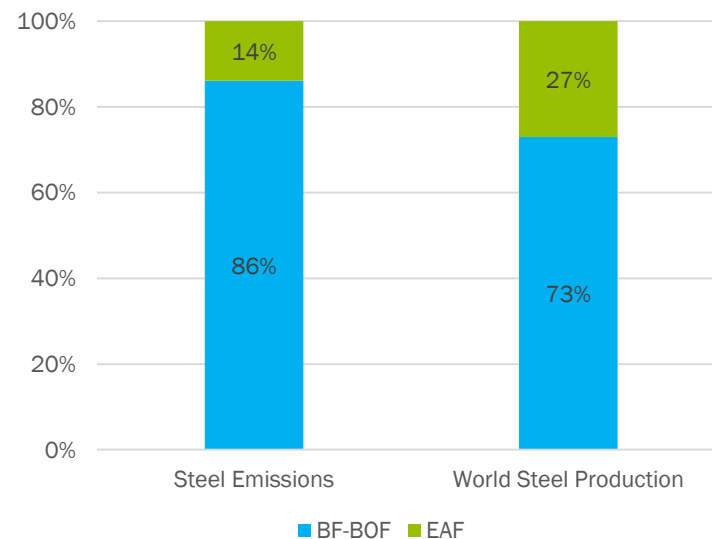
Source: <https://worldsteel.org/media-centre/press-releases/2021/world-steel-in-figures-2021-now-available/>;

# Steel: Specific emissions

CO<sub>2</sub> emissions per ton of steel in China (CN), Germany (DE), the EU, the US and Mexico (MX) by process route



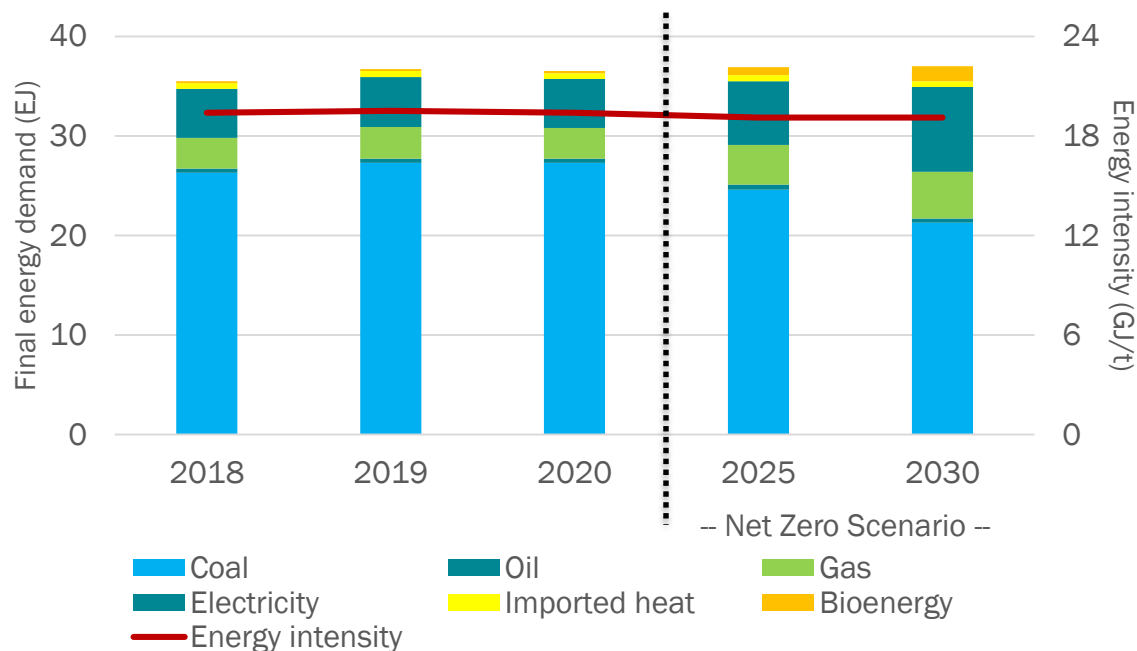
Global Steel Industry CO<sub>2</sub> Emissions (2019)



Source: [https://www.bdsv.org/fileadmin/user\\_upload/Final\\_Scrap\\_Bonus\\_PDF\\_49.pdf](https://www.bdsv.org/fileadmin/user_upload/Final_Scrap_Bonus_PDF_49.pdf); <https://www.iea.org/articles/global-co2-emissions-in-2019>; <https://www.iea.org/reports/iron-and-steel>

Daniela Thrän: Biomass in energy intensive industries | Workshop on “Bio-economy in a net-zero European industry” at networking event at DBFZ in Leipzig, 30.-31.05.2022, Day 2

# Iron and steel final energy demand and energy intensity in the Net Zero Scenario, 2018 - 2030



- 2020:  
Energy demand  
= 36,5 EJ
- Of that  
0.2 EJ from biomass  
 $\triangleq 0.54\%$
- 2030  $\rightarrow$  1.5 EJ from  
biomass

Source: <https://www.iea.org/reports/iron-and-steel>

# Steel: Switching to biomass as feedstock



The greatest potential for on-site biomass integration is for the integrated blast furnace-basic oxygen furnace route

→ biomass can partially substitute for fossil fuels at the coke making stage

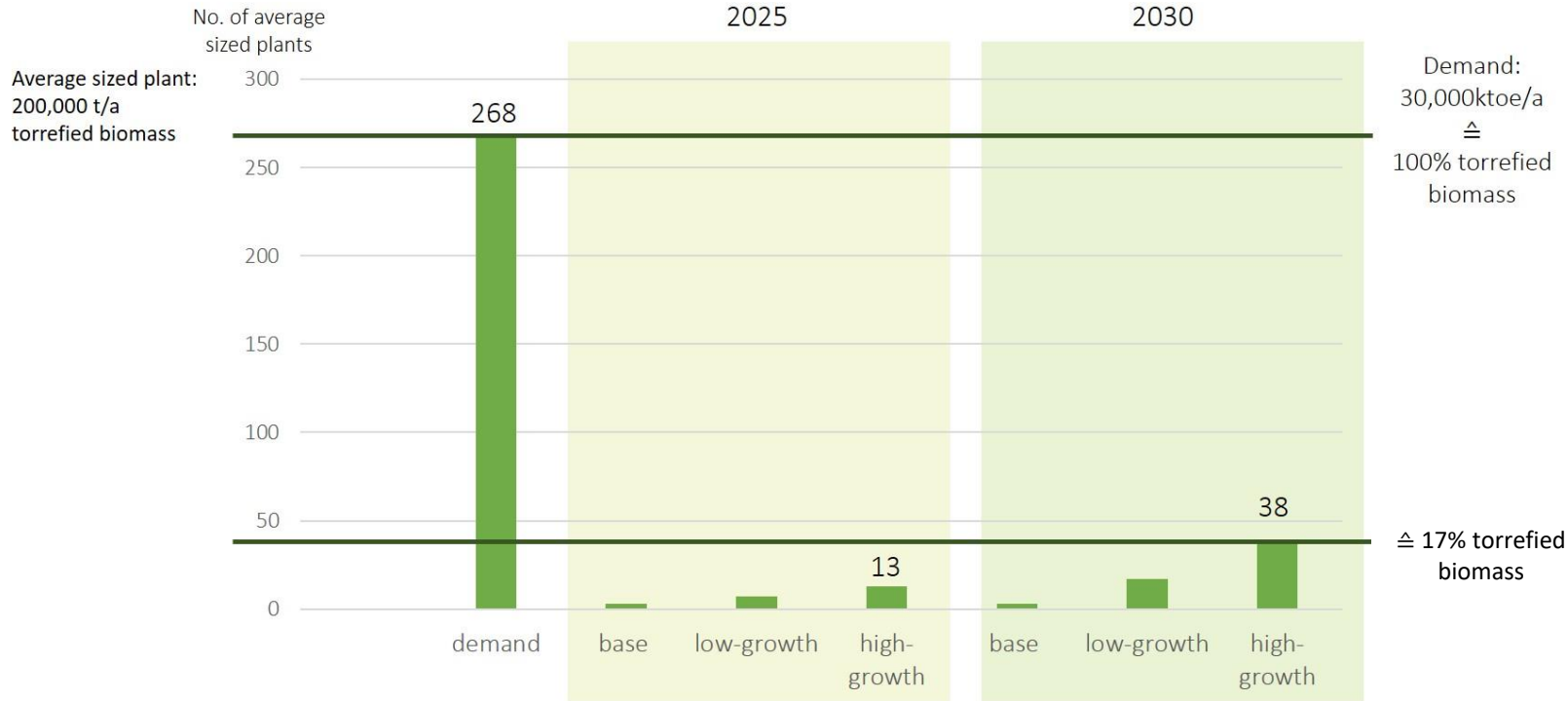
Challenge: matching biomasses with pre-treatment technologies (e.g. torrefaction, pyrolysis, charcoal production) to meet these requirements while being cost-effective and overall-emission saving

- **Feedstock availability crucial!** → European Bioeconomy Strategy: Residues & Waste for energy demand
- **Synergies with other technologies** e.g. Carbon Capture Storage (CCS) = negative emissions

Sources: <https://search.informit.com.au/documentSummary;dn=191853314279437;res=IELENG> ; <https://doi.org/10.1016/j.seta.2018.03.001>

# EU-27: Potential of Biomass for Steelmaking

## Torrefied biomass as transformation input in blast furnaces



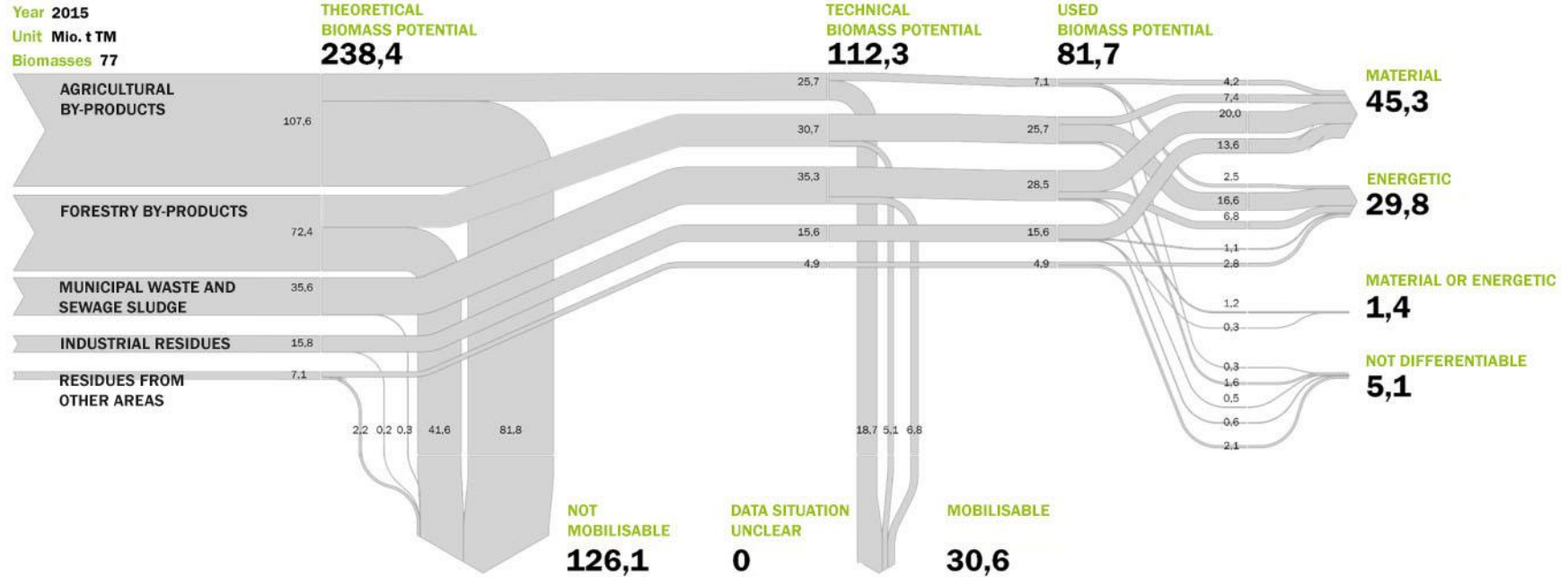
Source: Pfeiffer et al. 2020, MUSIC Deliverable 2.2, Description of IBC Market Potential, based on: [Eurostat Energy Balances](#) (EU-27) & EU Reference Scenario 2016: Energy, transport and GHG emissions, Trends to 2050 (European Commission, 2016)

# Limited Biomass Potential (Germany)

Biomass potential in Germany: resource monitoring



## AVERAGE VALUES



Source: Brosowski et al.: How to measure the impact of biogenic residues, wastes and by-products: Development of a national resource monitoring based on the example of Germany, Biomass and Bioenergy, Volume 127, 2019



# Biomass examples



Straw



Forest residues



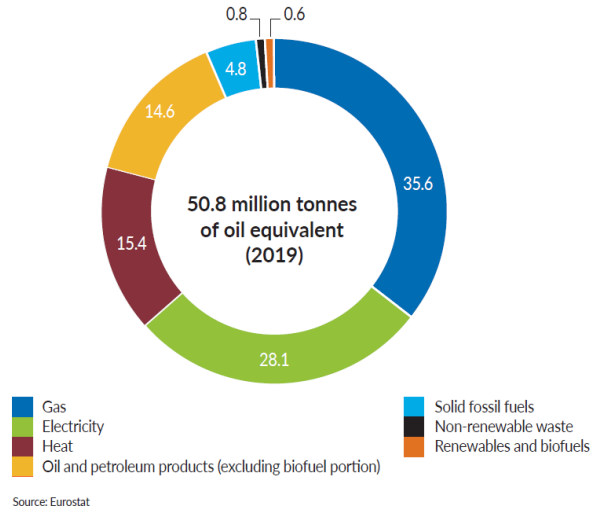
Bio waste



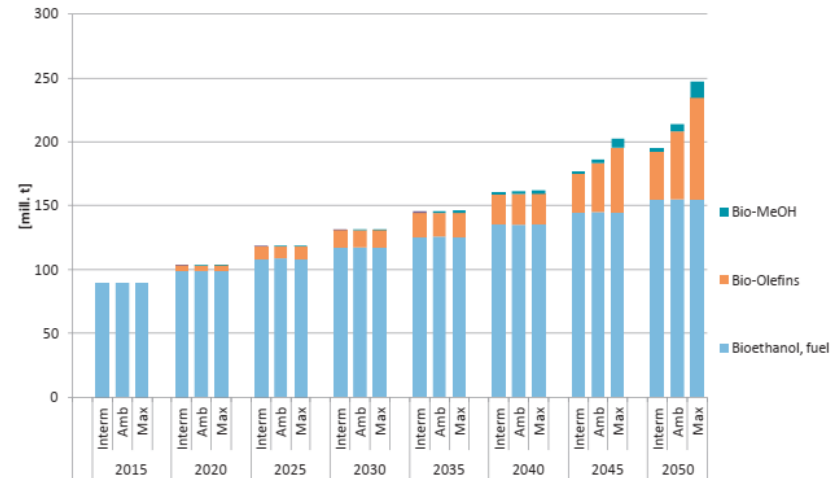
Corn stalks

# Chemicals: Overview

Total energy consumption in the EU27 chemical industry by source (%)



Growing biomass demand as feedstock in net zero scenarios



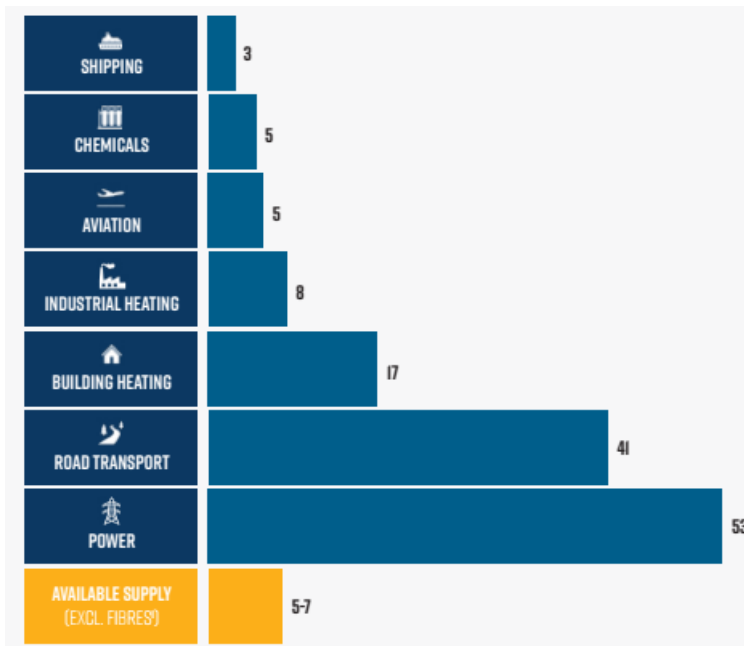
→ to reach net zero ambitions material used fossil fuels have to be largely replaced by renewable alternatives

Source: DECHEMA-Low carbon energy and feedstock for the European chemical industry

# Outlook: Material or energetic use

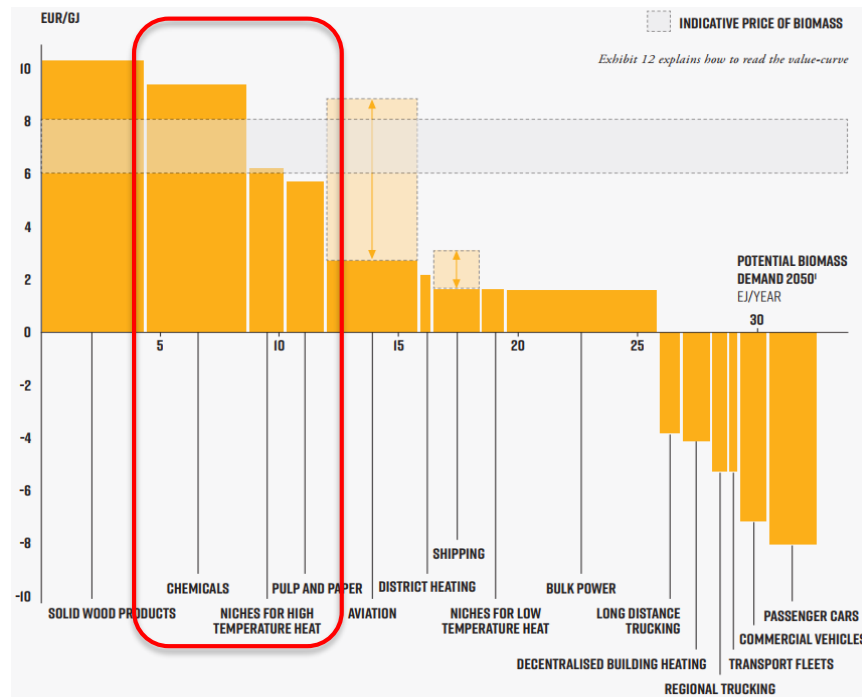
## Potential biomass demand per end-use

EJ biomass per year, EU



## Biomass value

Break-even biomass price at which the biomass application is competitive against alternative zero-CO<sub>2</sub> option in a specific segment (2050)



Source: <https://materialeconomics.com/latest-updates/eu-biomass-use>

# Summary

- **Biomass can support in the short term net zero ambitions**
- **Material use will generate the highest value for biomass**
  - **But biomass potential is limited**
  - **Policy frame is expected here**
- **Challenges: extension of value chains towards a circular bioeconomy, supply chain development, feedstock availability and quality**
  - **Greater range of business models, look for alternatives**

## Smart Bioenergy – Innovations for a sustainable future

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