

Biomass in energy intensive industries

Prof. Dr.-Ing. Daniela Thrän¹, Fabian Riedel²

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

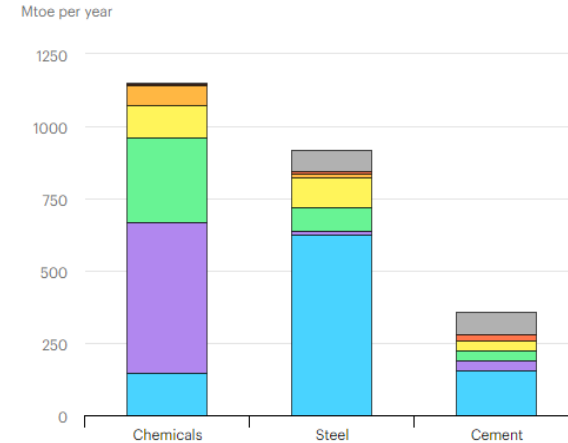
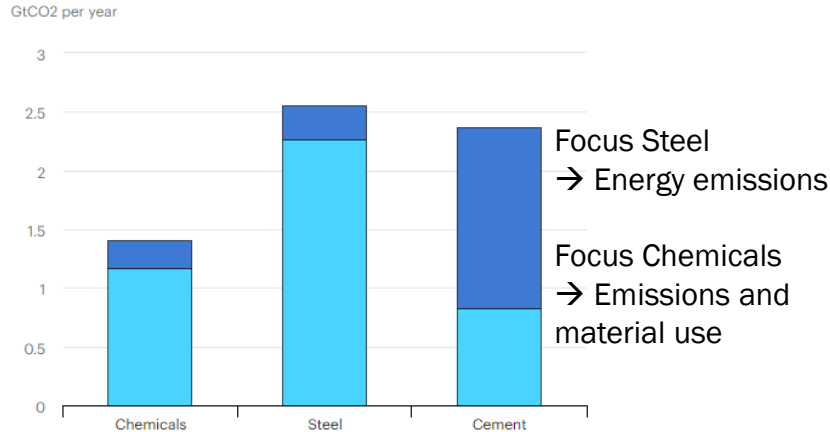


Workshop on "Bio-economy in a net-zero European industry"
at networking event at DBFZ in Leipzig, 30.-31.05.2022, Day 2

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



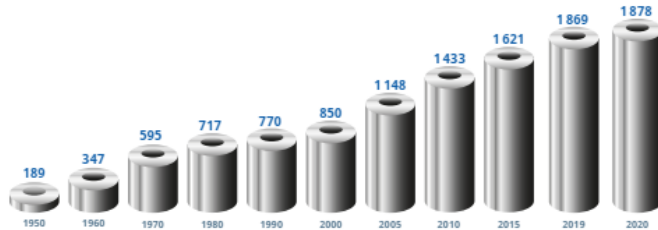
● Energy emissions ● Process emissions

● Coal ● Oil ● Gas ● Electricity ● Imported heat ● Bioenergy ● Other Renewables

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)

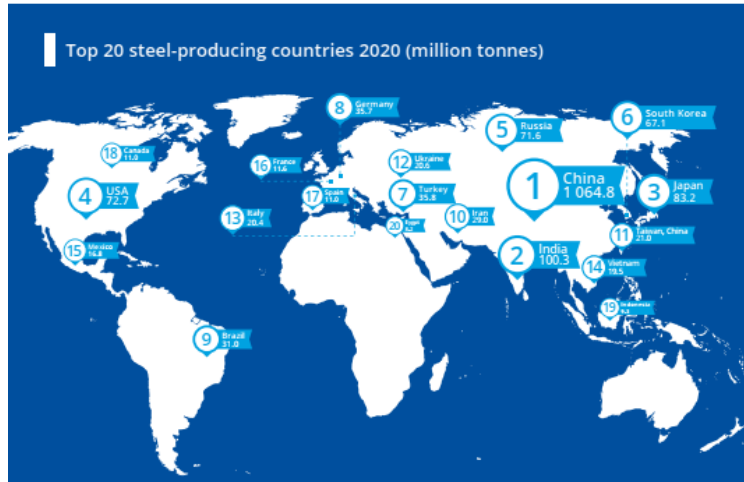


Global Emissions

2019: approx. 3.6 Gt CO₂

→ the global steel industry accounted for ~11% of total global CO₂ emissions in 2019

Top 20 steel-producing countries 2020 (million tonnes)



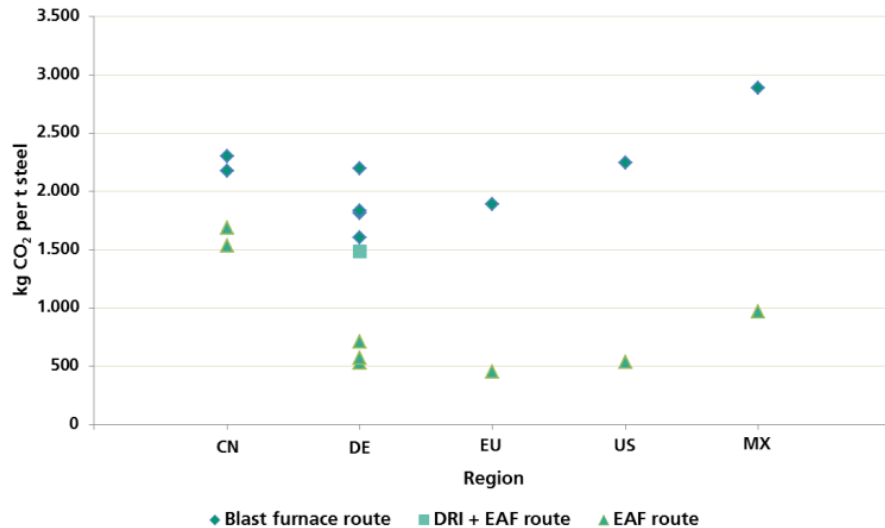
European Emissions

- 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

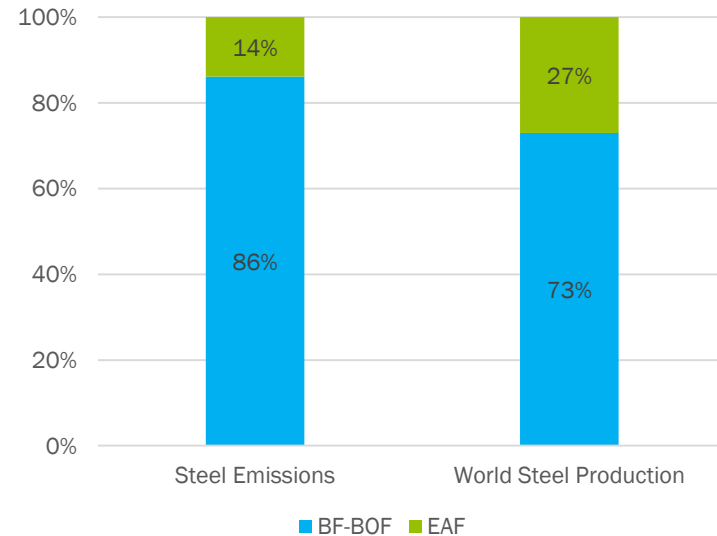
Source: <https://worldsteel.org/media-centre/press-releases/2021/world-steel-in-figures-2021-now-available/>;

Steel: Specific emissions

CO₂ emissions per ton of steel in China (CN), Germany (DE), the EU, the US and Mexico (MX) by process route

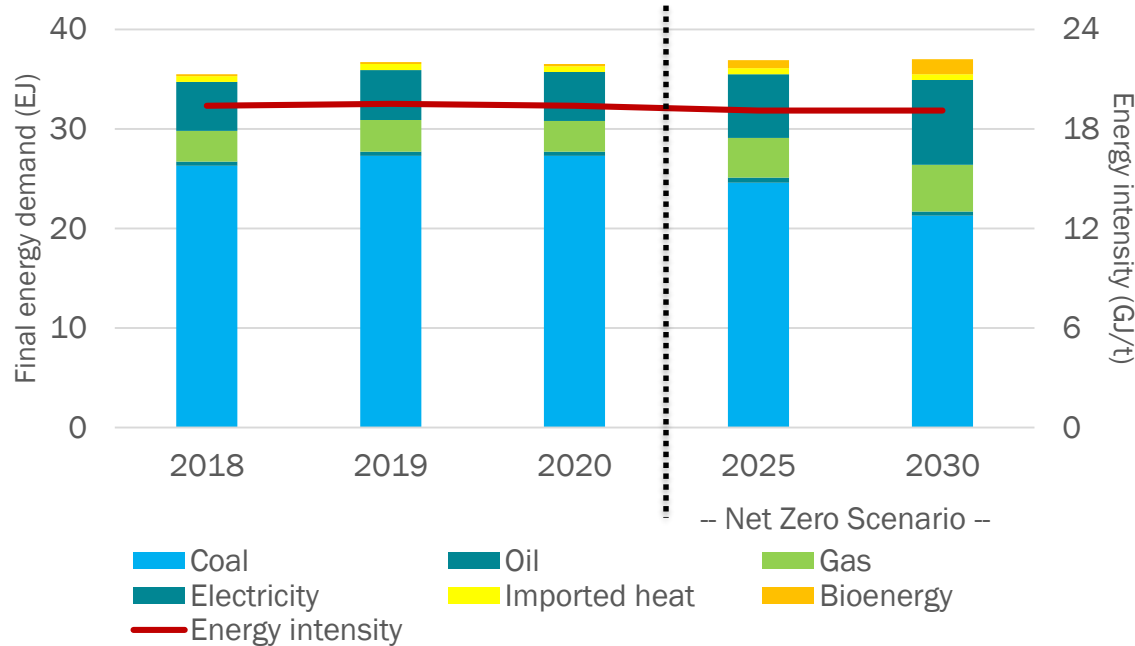


Global Steel Industry CO₂ Emissions (2019)



Source: 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>

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
≅ 0.54%
- 2030 → 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

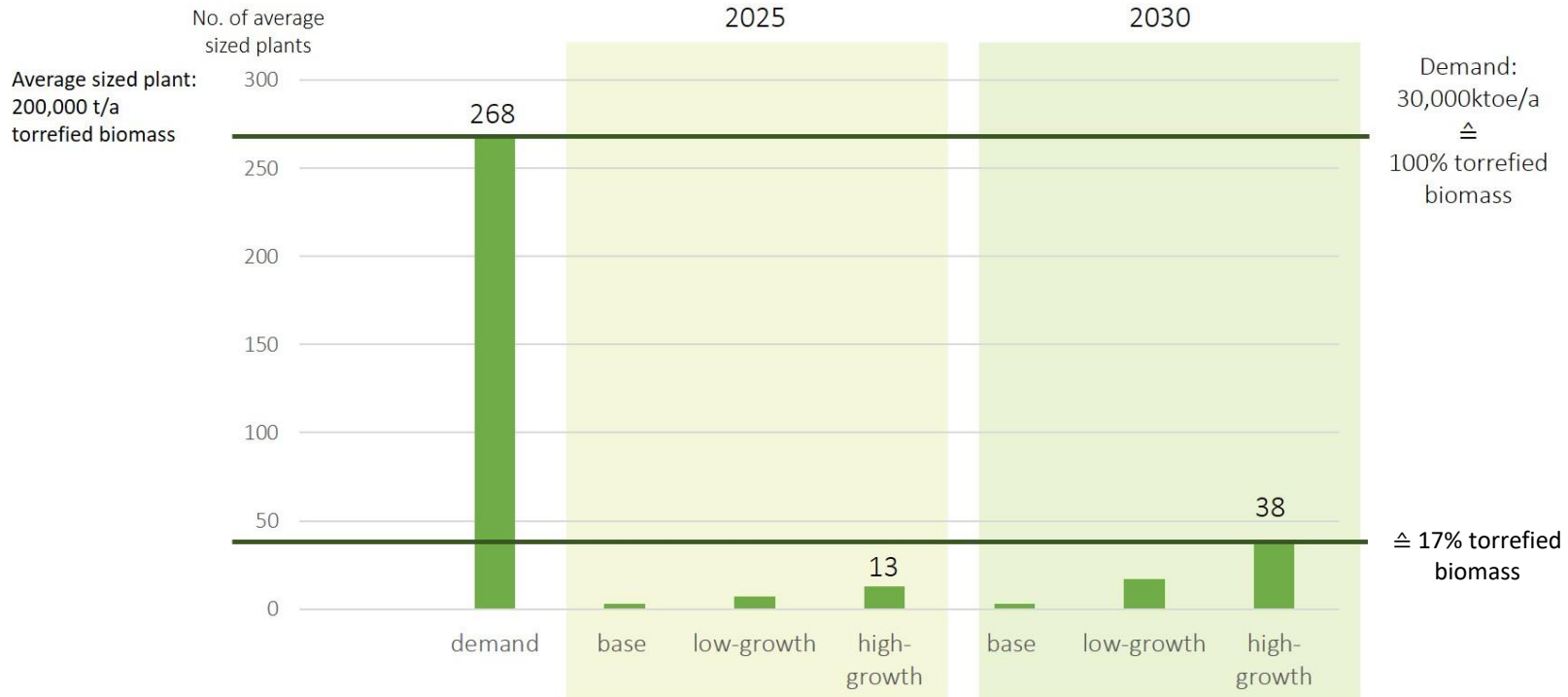
Challenge: matching biomasses with pre-treatment technologies (e.g. torrefaction, pyrolysis, charcoal production) to meet these requirements while being cost-effective and overall-emission saving

- **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)

Biomass examples



Straw



Forest residues



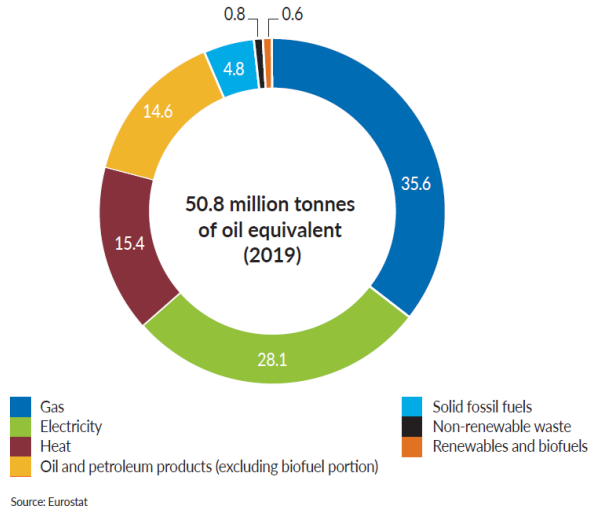
Bio waste



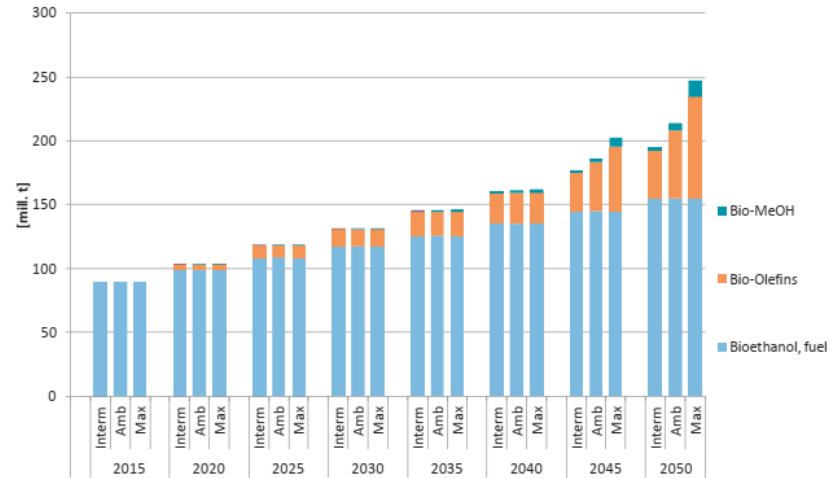
Corn stalks

Chemicals: Overview

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



Growing biomass demand as feedstock in net zero scenarios



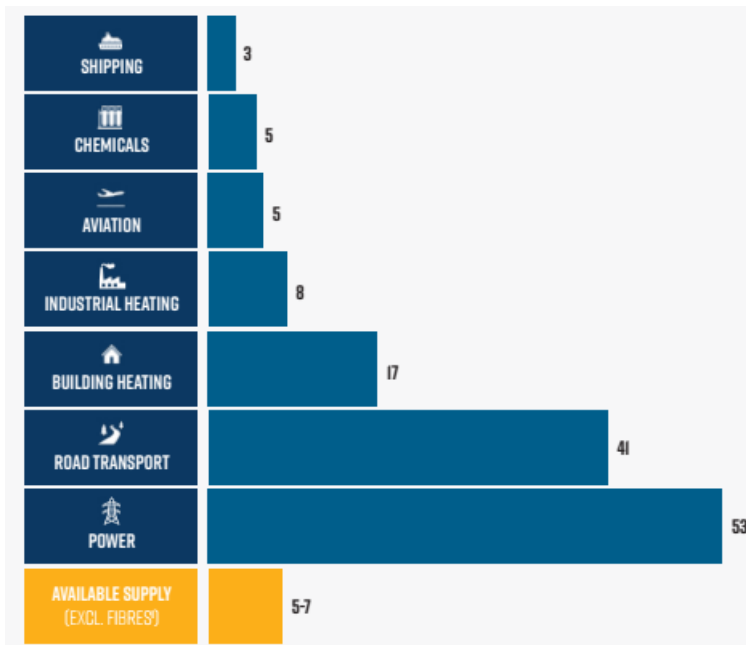
→ to reach net zero ambitions material used fossil fuels have to be largely replaced by renewable alternatives

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

Outlook: Material or energetic use

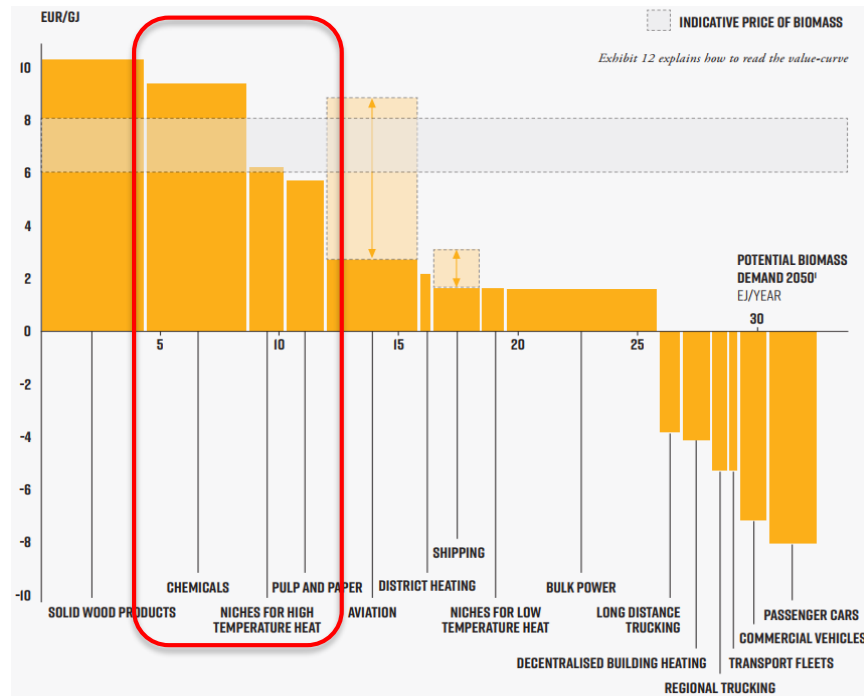
Potential biomass demand per end-use

EJ biomass per year, EU



Biomass value

Break-even biomass price at which the biomass application is competitive against alternative zero-CO₂ 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

Prof. Dr.-Ing. Daniela Thrän

Head of Bioenergy Systems Department
at DBFZ

Phone: +49 (0)341 2434-435

E-Mail: daniela.thraen@ufz.de

**DBFZ Deutsches
Biomasseforschungszentrum
gemeinnützige GmbH**

Torgauer Straße 116

D-04347 Leipzig

Phone: +49 (0)341 2434-112

E-Mail: info@dbfz.de

www.dbfz.de