IEA Bioenergy
Technology Collaboration Programme

Decarbonizing process heat for industry: the role of biomass

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Background on IEA Bioenergy

- Technology Collaboration Programme (TCP) organized under the auspices of the IEA
- Work carried out in 11 thematic expert groups (”Tasks”)
- *Bioenergy for High Temperature Heat in Industry* – an IEA Bioenergy Inter-Task project
  - Task 32 (*Biomass combustion*)
  - Task 33 (*Thermal gasification of biomass*)
  - Task 34 (*Direct Thermal Liquefaction*)
  - Task 36 (*Material and energy valorisation of waste in a circular economy*)
  - Task 40 (*Deployment of biobased value chains)*

Industrial heat - characteristics

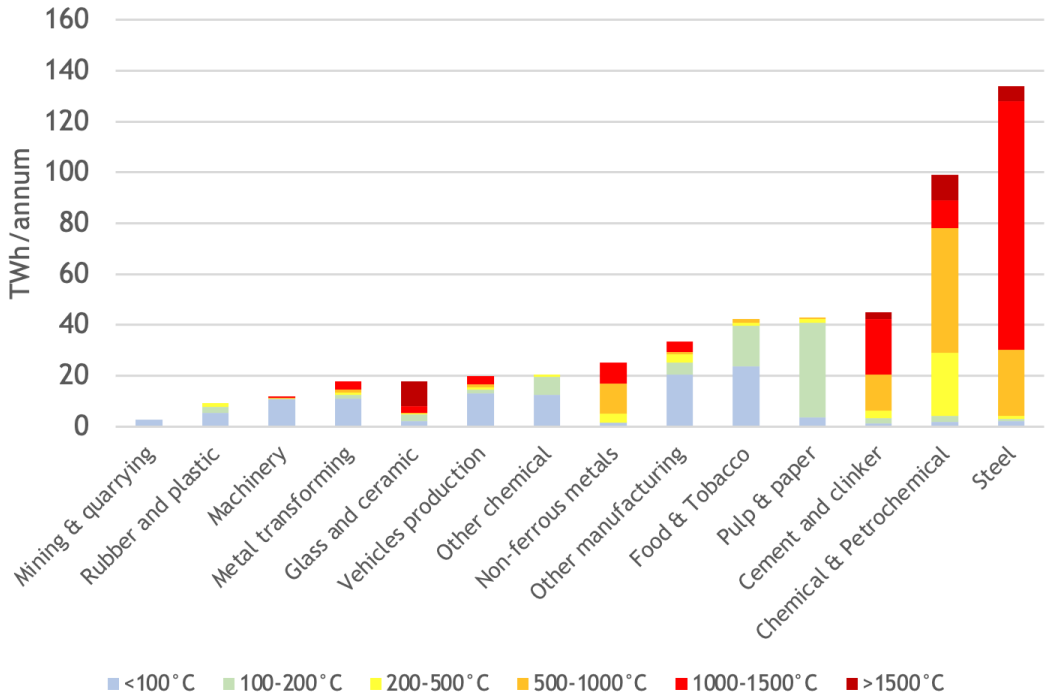
- Industry ~30% of global GHG emissions – though not all of it from heat
- Industrial heat is very diverse – many different applications that vary in
  - Temperature
  - Direct/indirect heat
  - Control & flexibility
  - …
- Heterogeneity -> difficult to generalize (and difficult to analyze!)

Example: which temperature intervals should be used?

Naegler et al (2015)	100°C	100-500°C	500-1000°C	>1000°C		
Philibert (2017)	<150°C	150-400°C	>400°C			
Bataille et al (2018)	<250°C	250-1000°C	>1000°C			
McKinsey & Co (2018)	<100 °C	100-500°C	500-1600°C	>1600 °C		
Malico et al (2019)	<100 °C	100-200°C	200-500°C	>500°C		
ARENA (2019)	< 150°C	150-250°C	250-800°C	>800°C		
Madeddu et al (2020)	<100 °C	100-400°C	400°C-1000°C	>1000°C		
Lenz et al (2020)	<100 °C	100-200°C	200-500°C	500-1000°C	1000-1500°C	>1500°C

But if we still try to generalize…

- High temperatures (>500°C) especially in metals and minerals processing – direct heating
- Lower temperatures (~50-500°C) in wide variety of sectors, indirectly (incl via steam)

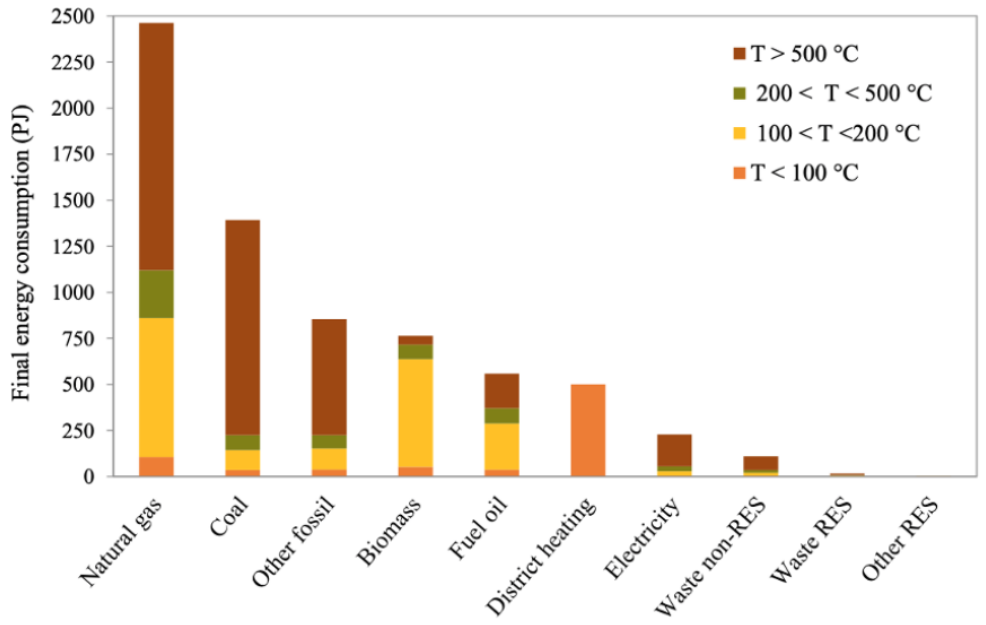


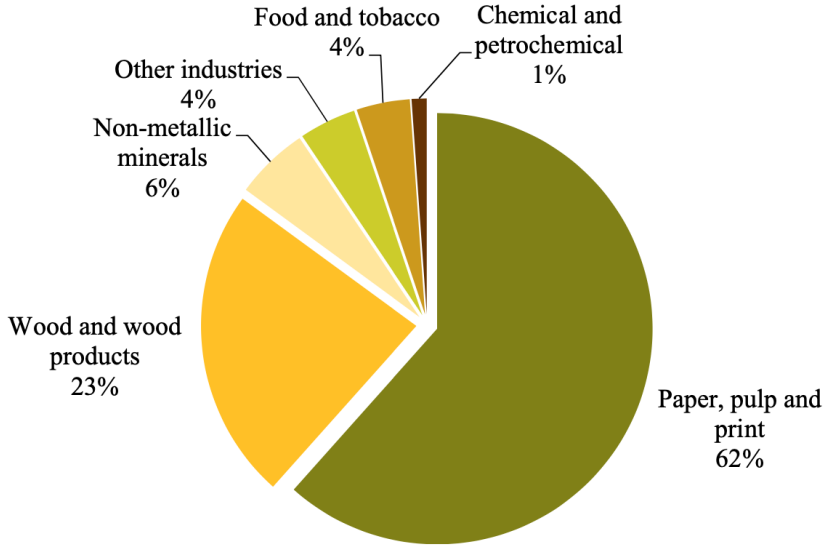
2013 industrial heat use in Germany
(Data from Lenz et al, 2020)

Industrial heat decarbonization options – hot takes

- CCS: avoids stranding of assets, but costly & infrastructure challenging
- Electrification: feasible at lower temps, less mature at higher temps
- Hydrogen: allows retrofitting of natural gas heating, but costs challenging
- Biomass?

Use of biomass in industrial heat (EU)





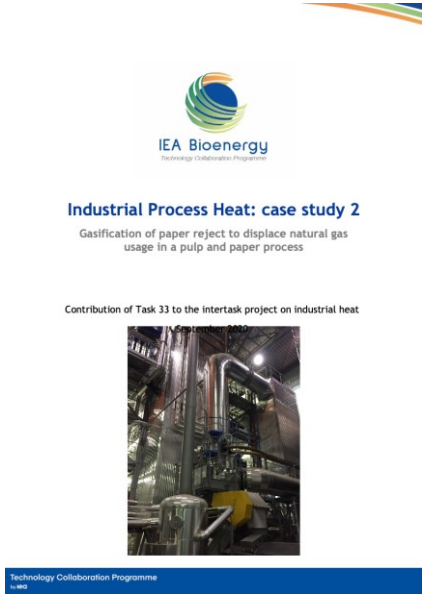
Figures from Malico, I., Pereira, R. N., Gonçalves, A. C. and Sousa, A. M. (2019). Current status and future perspectives for energy production from solid biomass in the European industry. *Renewable and Sustainable Energy Reviews*, 112. 960–77.

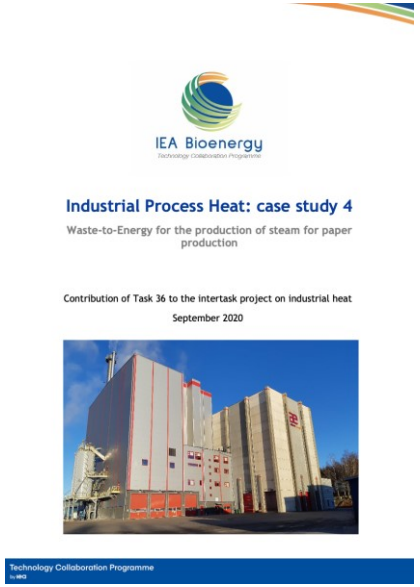
Potential for bioenergy in industrial heat

- Pros
  - Comes in many different forms, so can cover most needs currently met by fossil fuels
  - Retrofits could therefore be relatively small
  - Can enable negative emissions when combined with CCS

- Cons
  - Technological maturity varies
  - Difficult to generalize because local availability key for price
  - Larger volumes may be expensive and complicated to source

Again, difficult to generalize, - let's draw on examples





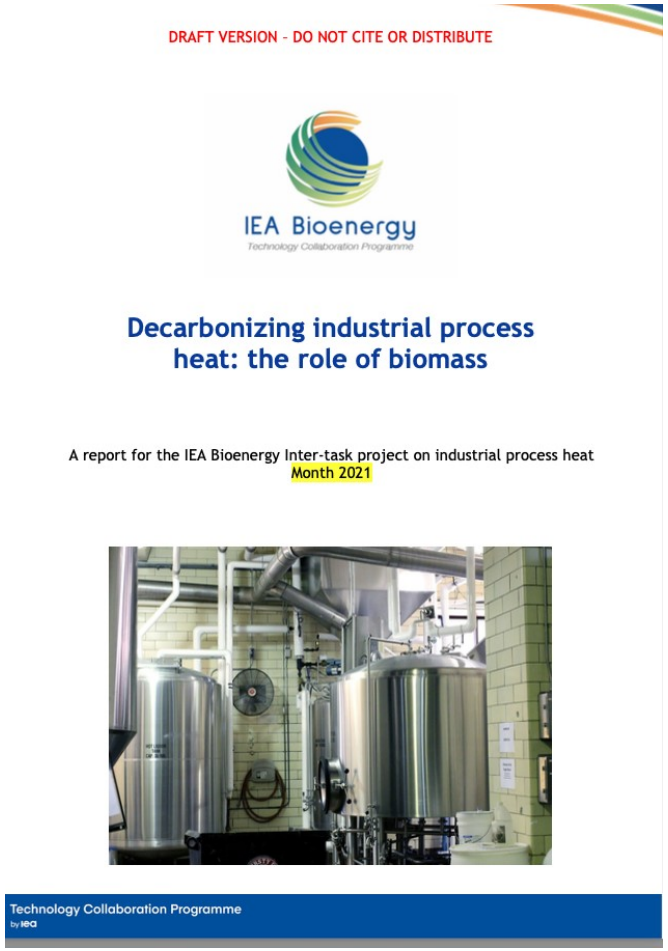
https://itp-hightemperatureheat.ieabioenergy.com/iea-publications/

Lessons from the cases

- Choice of solution depends on existing technology, biomass availability and site-specifics related to logistics
- Cost reductions key driver
- Low/high opex vs low/high capex?
- Strong relationships in value chain important

Moving forward & policy aspects

- EU ETS (+CBAM?)
- Public procurement
- Value chain collaborations:
  - Cost increases in processes may be miniscule if carried to sticker price
  - Brand owners, OEMs etc push towards lower life cycle emission products?
- Opportunities for biomass **by adding value**, e.g., through bio-CCS & CDR



(Coming soon!)

Thank you!

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