




BEST


Bioenergy and
Sustainable Technologies



 Federal Ministry
Innovation, Mobility
and Infrastructure
Republic of Austria

 Federal Ministry
Economy, Energy
and Tourism
Republic of Austria



 For the
City of Vienna



Integration of pyrolysis energy and products into the circular economy

Wieselburg, 23rd of September 2025


Franziska Klauser



 Federal Ministry
Innovation, Mobility
and Infrastructure
Republic of Austria

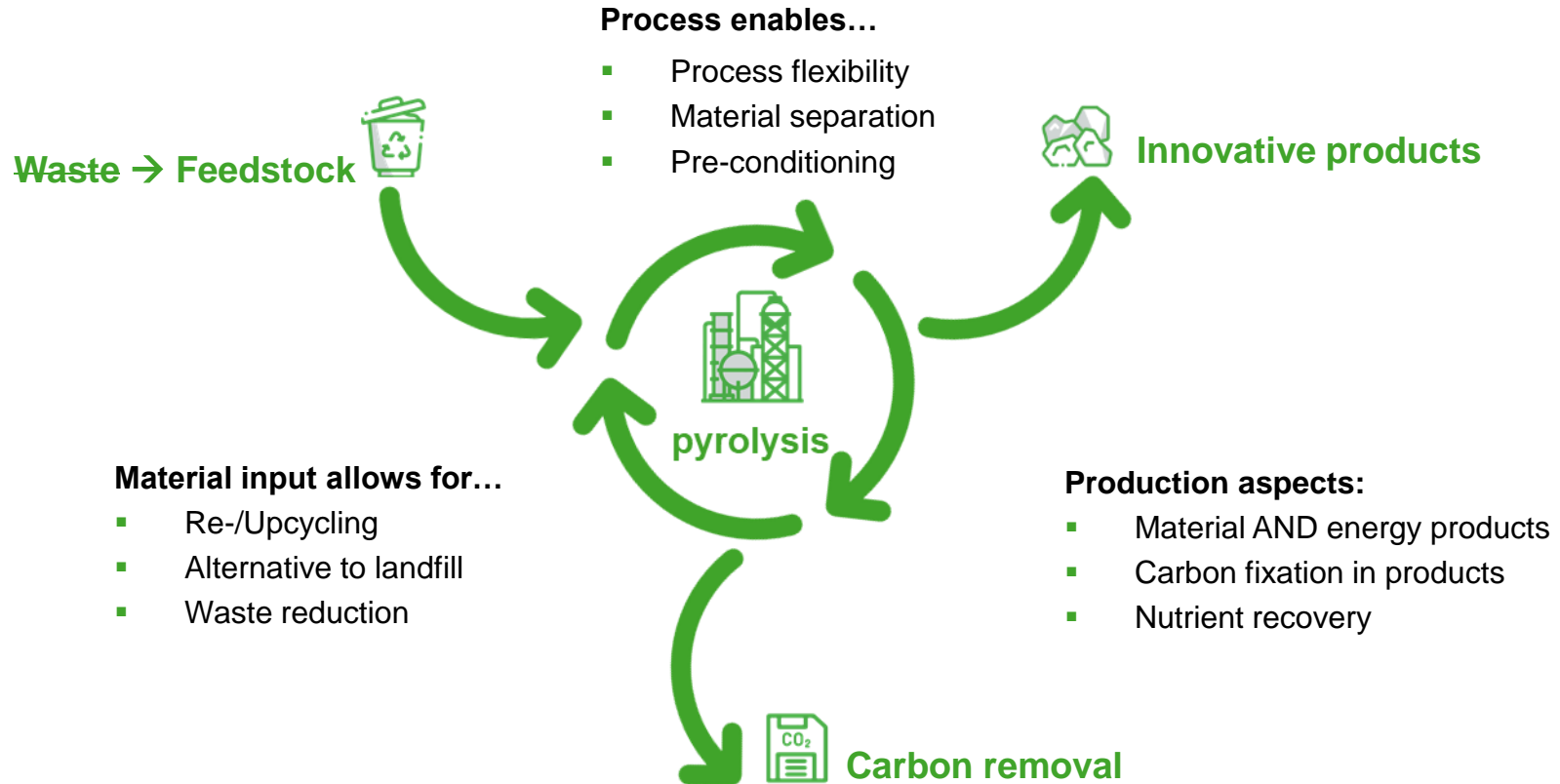
 Federal Ministry
Economy, Energy
and Tourism
Republic of Austria



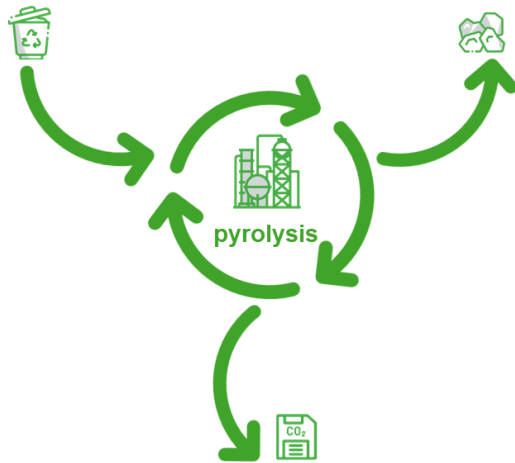
 For the
City of Vienna



Pyrolysis as HUB in the Circular Economy



From technology to business concept



Complexity because of interdependencies:
Feedstock ↔ technology ↔ product

Project's main objectives?

- Product commercialization
- Waste disposal
- Energy requirement

Business concept

- Value chain?
- Sidestreams?
- Markets?
- Partners?

Production focus (1/2)

19 technologies for intermediate pyrolysis

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S |
|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| biochar | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ |
| Pyrolysis oil | | | █ | █ | | | █ | | | | | █ | █ | | | | █ | | |
| Wood vinegar | | | | █ | | | | | | | | █ | | | | | █ | █ | █ |
| Pyrolysis gas | | | | █ | █ | | █ | | | | | █ | | █ | | | █ | | |
| Heat | █ | █ | | █ | | █ | █ | █ | █ | █ | | █ | █ | | | | █ | | |
| Power | | | | █ | | | | | | | | █ | █ | | | | █ | | |

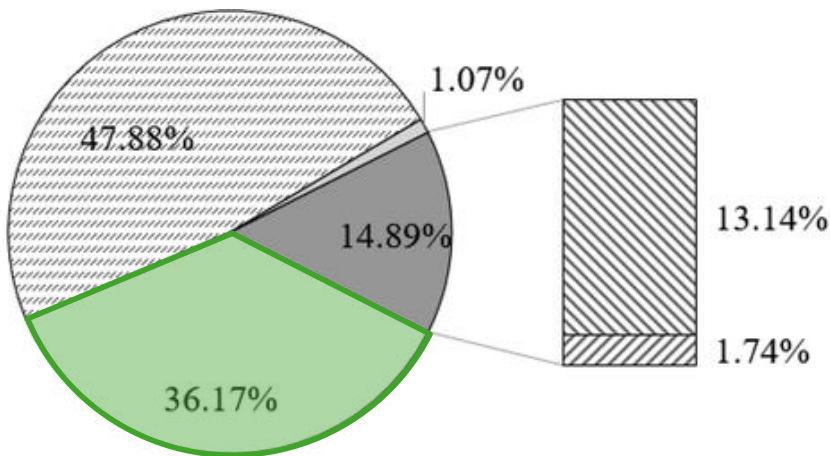
← Focus for developments

Pyrolysetechnologien in Europa:

<https://nachhaltigwirtschaften.at/de/projekte/pyrolysetechnologien-europa.php>

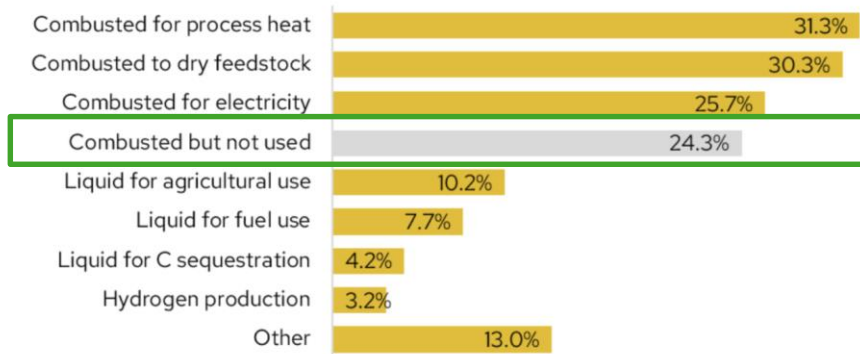
Production focus (2/2)

Energy share of pyrolysis products:



□ Pyrolysis gas □ Biochar □ Vinegar □ Wood tar □ Light oil

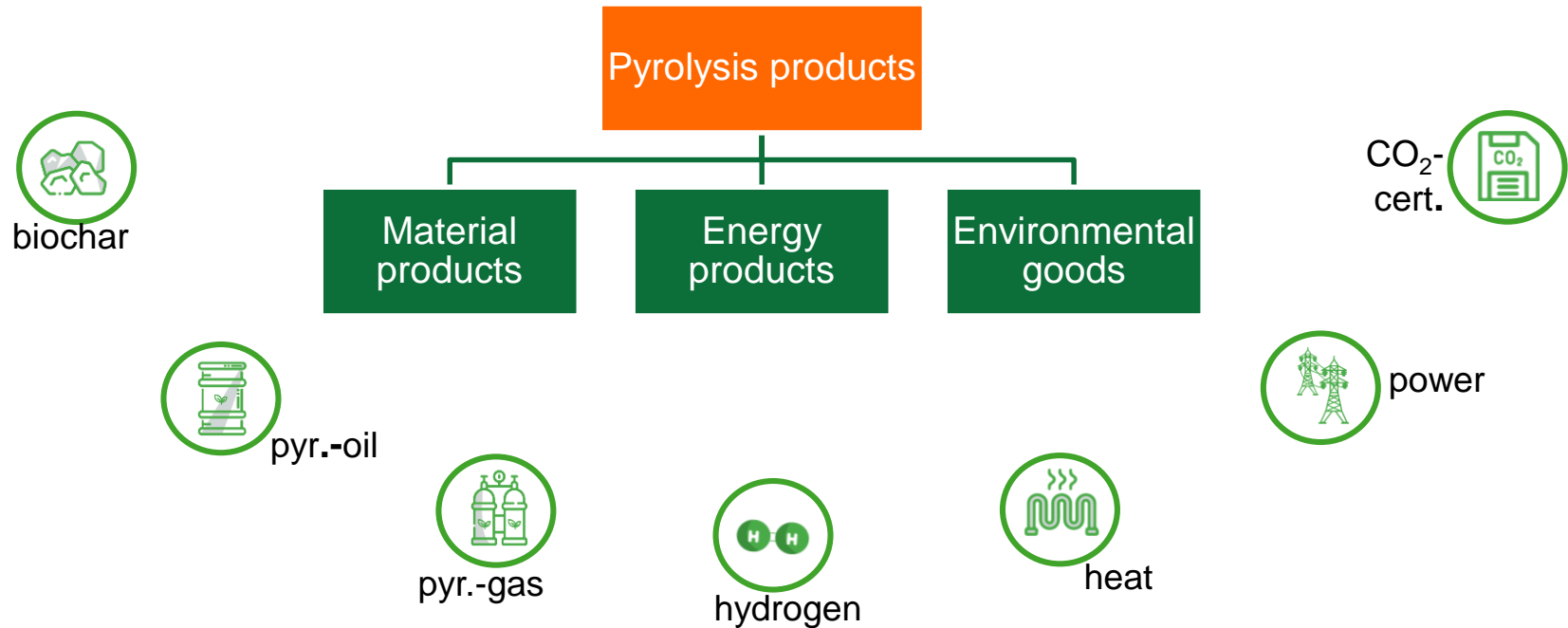
End-use of pyrolysis gas:



IBI, USBI (2024): Global Biochar Market Report, <https://biochar-international.org/wp-content/uploads/2024/06/Global-Biochar-Market-Report-2023-%E2%80%93-Public.pdf>

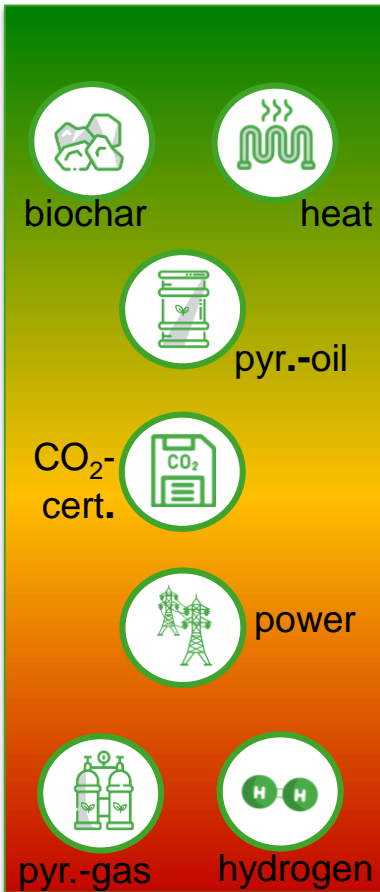
Cong et al, 2018: Slow Pyrolysis Performance and Energy Balance of Corn Stover in Continuous Pyrolysis-Based Poly-Generation Systems. <https://pubs.acs.org/doi/full/10.1021/acs.energyfuels.7b03175>

Product variety (1/2)



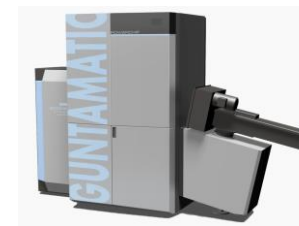
Product variety (2/2)

low ← use of pyrolysis products → high



Source: www.sonnenerde.at

Source: www.char-line.com



Powerchip Biochar

Source: www.guntamatic.com



T:Cracker – PyroDry

Source: www.nge.at



Source: sfbiochar.com

Source: www.corigin.co

Carbon Removal and Carbon Farming (CRCF) Regulation

https://climate.ec.europa.eu/eu-action/carbon-removals-and-carbon-farming_en

puro • earth

Source: puro.earth/



Carbonfuture

Source: www.carbonfuture.earth

PyFlex - Project

“Pyrolysis technology as an intersectoral flexibility measure in Germany's energy system”

Current status:

“uncertain markets ”

“energy markets depend on
EU/national/regional policies”

“flexible power generation contradicts
efficient char production”

“Profitability only when selling material
AND energy products!”

Future perspective (10-20 years):

“More product variety (H₂) and
flexibility (flexible power, syngas storage)”

“competition with other technologies”

“Higher technology variety on the
market for more specialized concepts”

“Great potential for highly
specialized business models”

Conclusions

- Operator`s main goal must be integrated into comprehensive concepts including feedstock availability to product marketing.
- Products are only then valuable, when there are reliable markets.
- Parallel commercialization of material and energy products is crucial for economic success.
- Pyrolysis is a highly versatile hub for circular economy.



Franziska Klauser
Researcher

franziska.klauser@best-research.eu

Sub-Area 1.1 Thermochemical Technologies
Gewerbepark Haag 3
3250 Wieselburg-Land

Thank you for your attention!



Quelle: <https://bio2oil.dk>



Quelle:
BEST



Quelle: BEST