

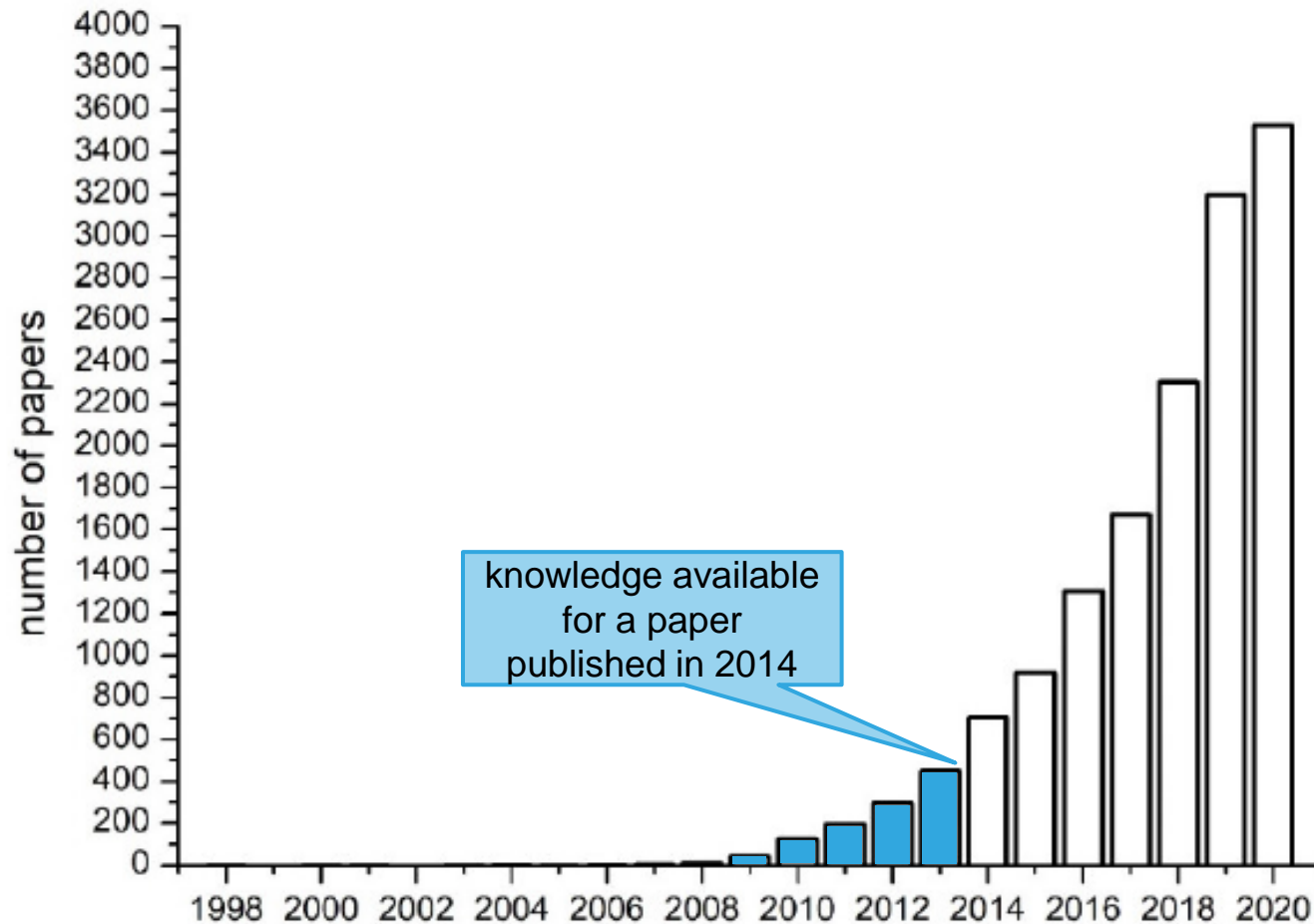


Biochar: Role as Negative Emission Technology and growth potential

Hansjörg Lerchenmüller; Biomass-based Carbon Sinks; NEP Webinar, 27. April 2021

Biochar science is showing enormous dynamics

Web of Science search for “biochar” as keyword

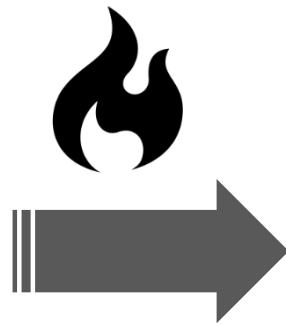


- **80% of all scientific papers with biochar as a keyword have been published in the last 5 years**

Conte, P. (2021) *Recent Developments in Understanding Biochar's Physical-Chemistry*

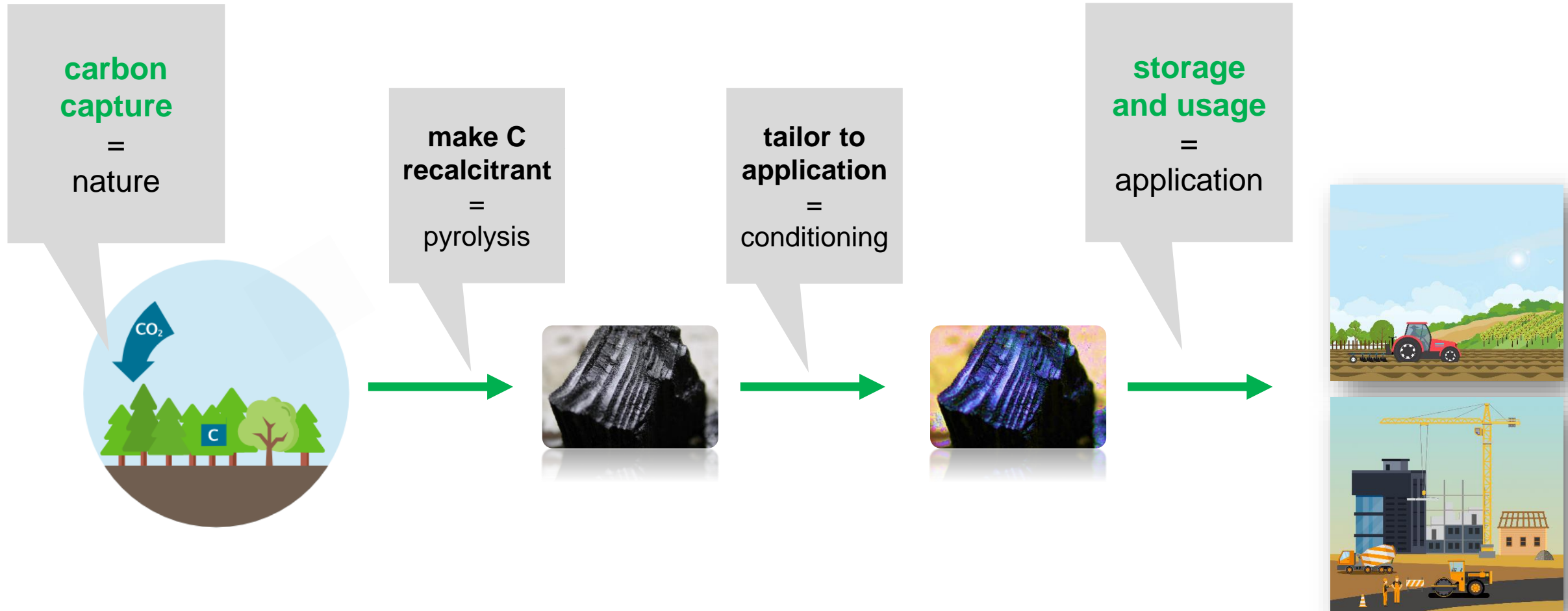
What is biochar?

Biochar is obtained from biomass by pyrolysis



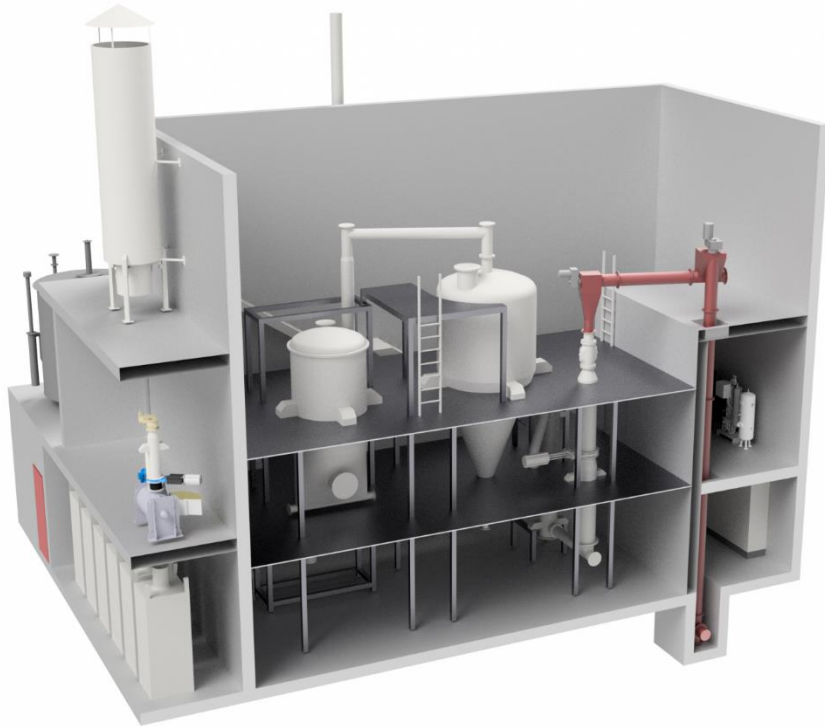
Biochar: Capturing carbon, using and storing it

Easy to produce, harmless to the environment, easy to transport, with a broad range of applications



Biochar manufacturing equipment

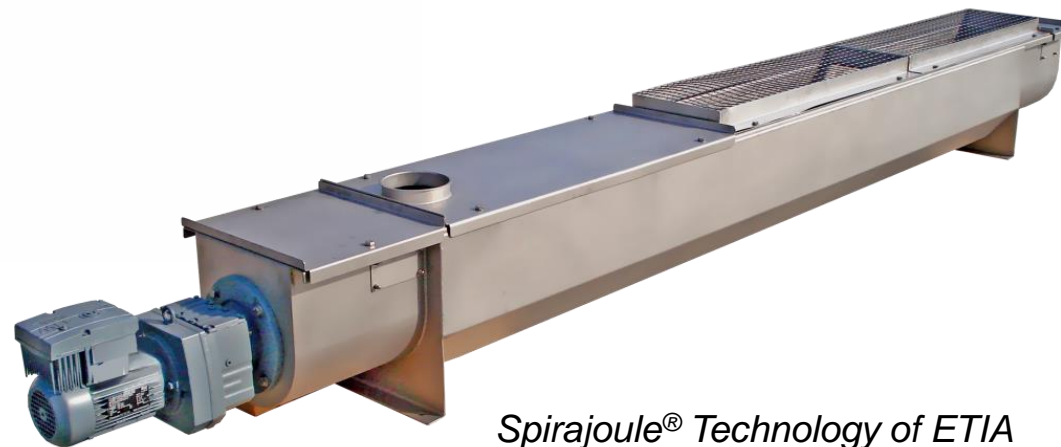
Examples for industrial equipment capable of producing biochar in EBC quality



SynCraft CW1800-500



PX1500 by PYREG



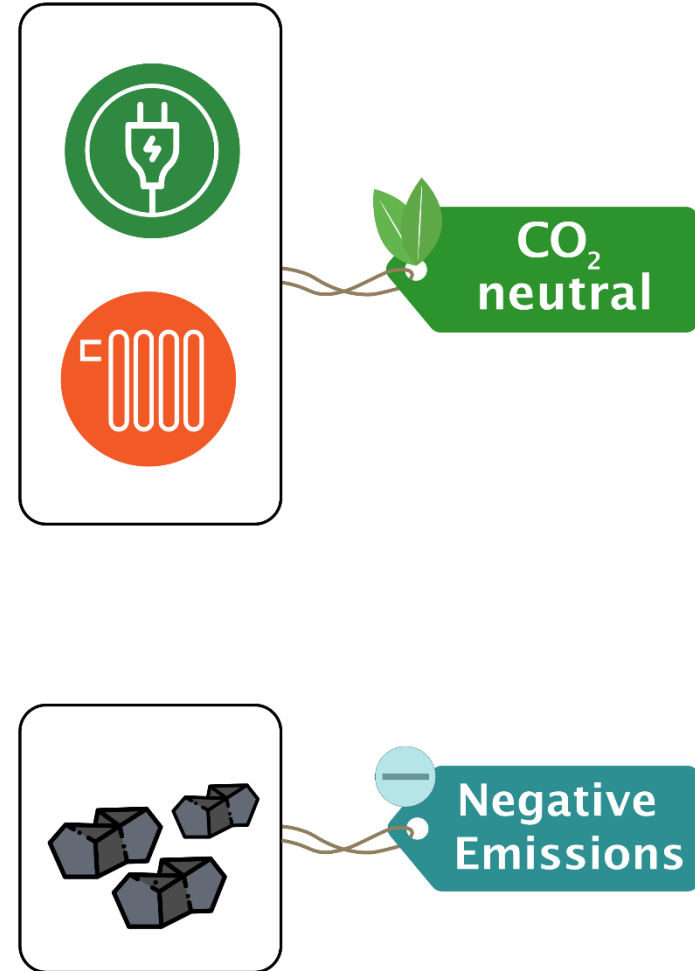
Spirajoule® Technology of ETIA

Biochar production goes hand in hand with bioenergy

Up to fourfold added value: electricity, heat, biochar and negative emissions

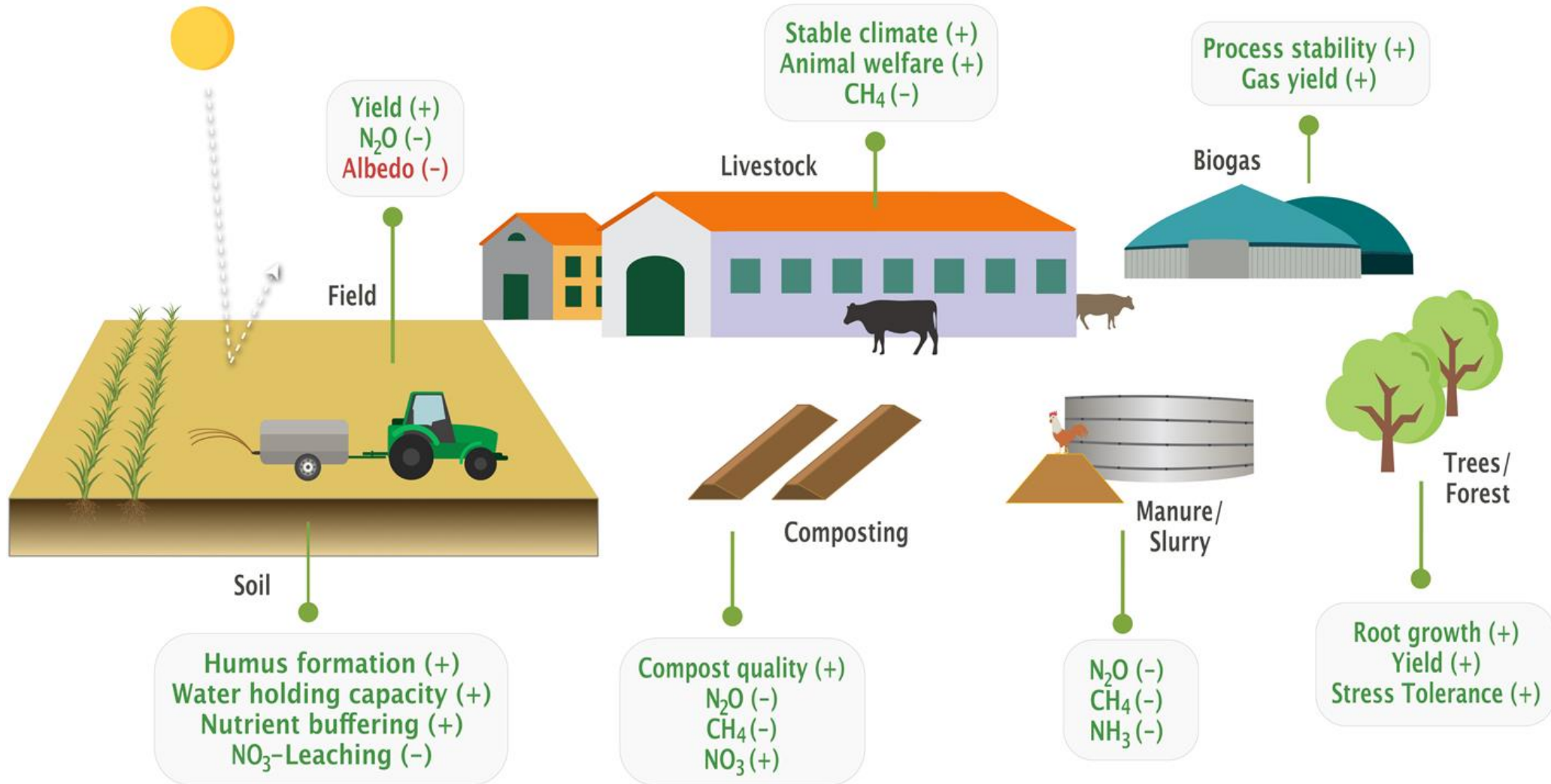


Plant of Energiewerk Ilg in Dornbirn



Application benefits of biochar

In the systems barn, manure/slurry, biogas plant, composting, field, trees/forest and soil



Pilot applications of biochar in construction and materials

Green Asphalt has successfully been demonstrated Austria, South Africa and Australia



- Standard composition
 - 85% gravel
 - 10% filler
 - 5% bitumen
- Reducing the filler to 8% and replacing it with 2% biochar makes asphalt climate-positive

Pilot applications of biochar in construction and materials

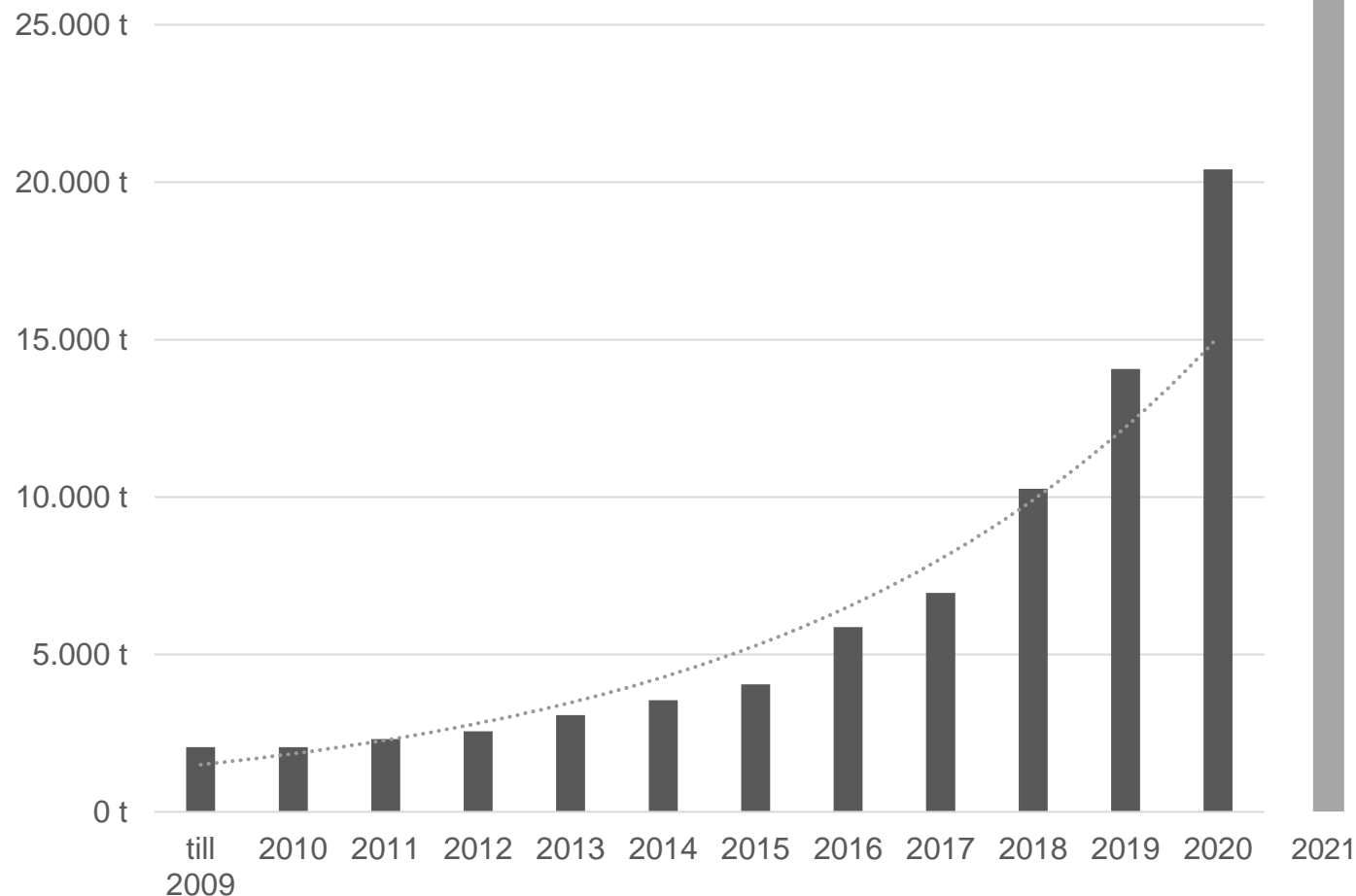
Biochar in façade elements acting as engineered carbon sink



500 m² of **made of air** biochar composite facade, >85% atmospheric carbon content

Biochar Market growth until 2020

Cumulative biochar production capacity in Europe



By **end of 2020** dedicated **production capacity for biochar** was just above **20.000 t**

Biochar production in 2020 was approximately **17.000 t**

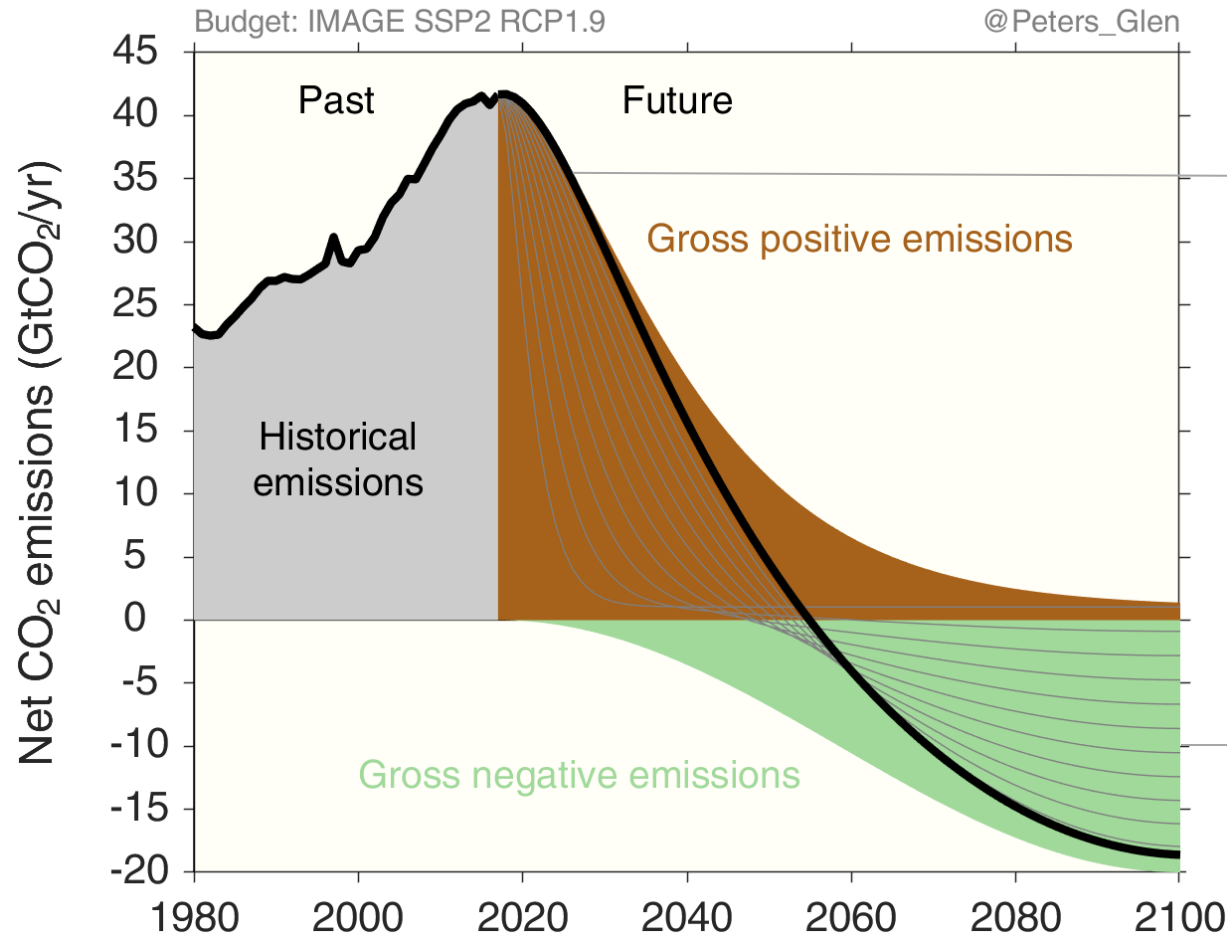
The **market is growing** substantially, and even its **growth is growing**

- Production capacity doubled in only two years from 2018 to 2020
- Growth rates for cumulative production capacity are increasing:
5y CAGR was 38%,
3y CAGR was even 43%

<https://www.biochar-industry.com/market-overview/>

The importance of negative emissions

In order to mitigate climate change, negative emissions at massive scale have to be established



The necessary **emission reduction** is addressed through policy instruments

At least 30% of the carbon removal required until 2050 will likely have to be covered by biochar

<https://www.cicero.oslo.no>

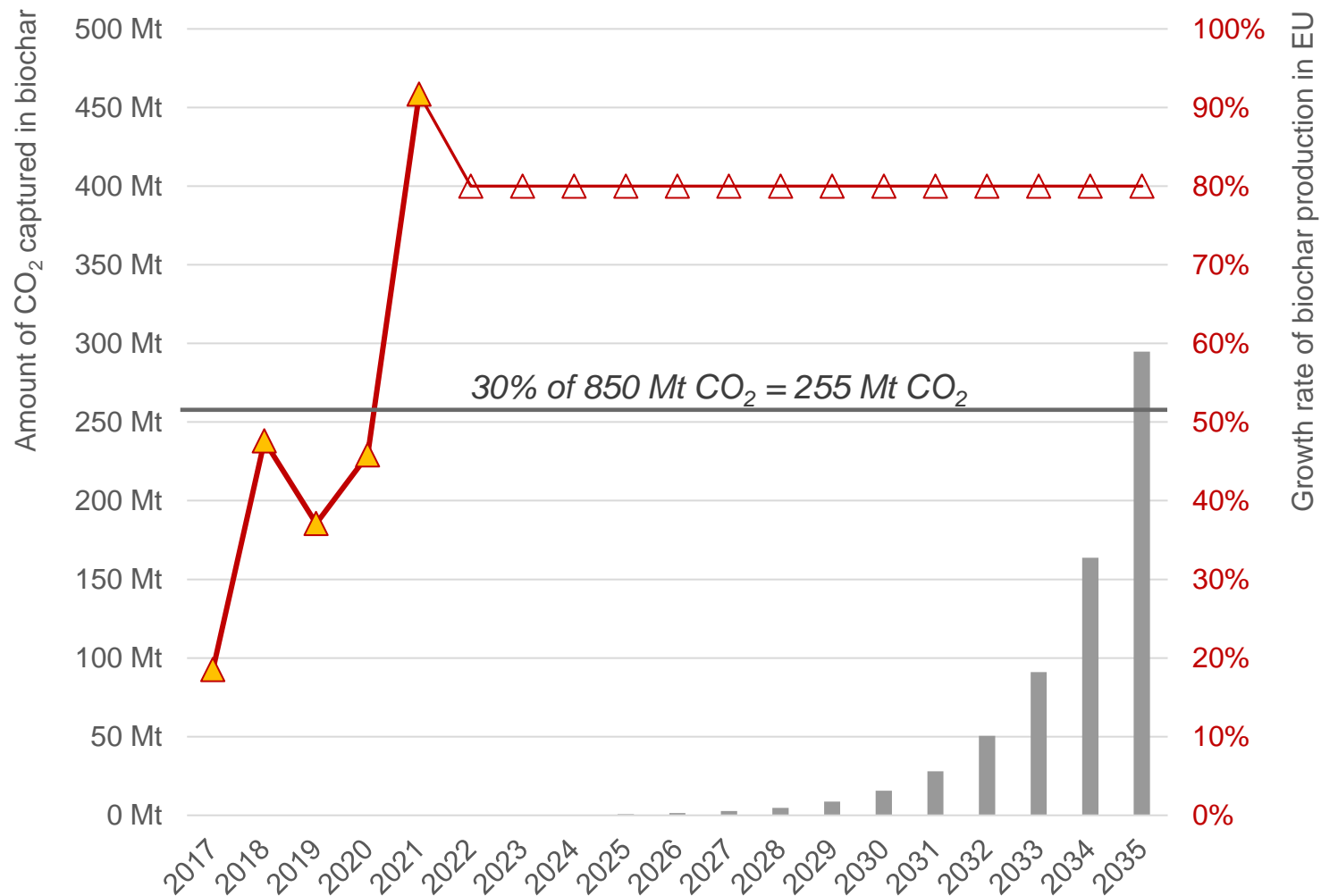
30% of 850 Mt/CO₂ (EBI Scenario for 2050 remaining emissions) equals

255

million tons of CO₂?

Is biochar capable of capturing 255 Mt of CO₂?

A scenario for future growth rates of the biochar production industry



Enablers to achieve this goal

- Actively remove obstacles based on most recent science (fertilizer regulations)
- Include biomass sources not accessible to carbonization today (e.g. sewage sludge)
- Allocate biomass smartly with pyrolysis at the end of the cascade



www.biochar-industry.com



LinkedIn page

A scanning electron micrograph (SEM) showing a highly porous, interconnected network of carbon-based structures, likely biochar. The structure consists of thin, overlapping layers and channels, creating a complex, three-dimensional lattice. The lighting highlights the edges and surfaces of these layers, giving it a textured, almost crystalline appearance. A dark horizontal band is overlaid across the middle of the image, containing the word 'Appendix' in white text.

Appendix

White Paper on Biochar

EBI Whitepaper
Biochar-based carbon sinks to mitigate
climate change



October 2020

Publisher

[European Biochar Industry Consortium e.V. \(EBI\)](#)

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- Dr. Hannes Junginger (carbonfuture GmbH)
- Prof. Dr. Daniel Kray (Offenburg University of Applied Sciences)
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- Pål Jahre Nilsen (EBI, VOW/ETIA)

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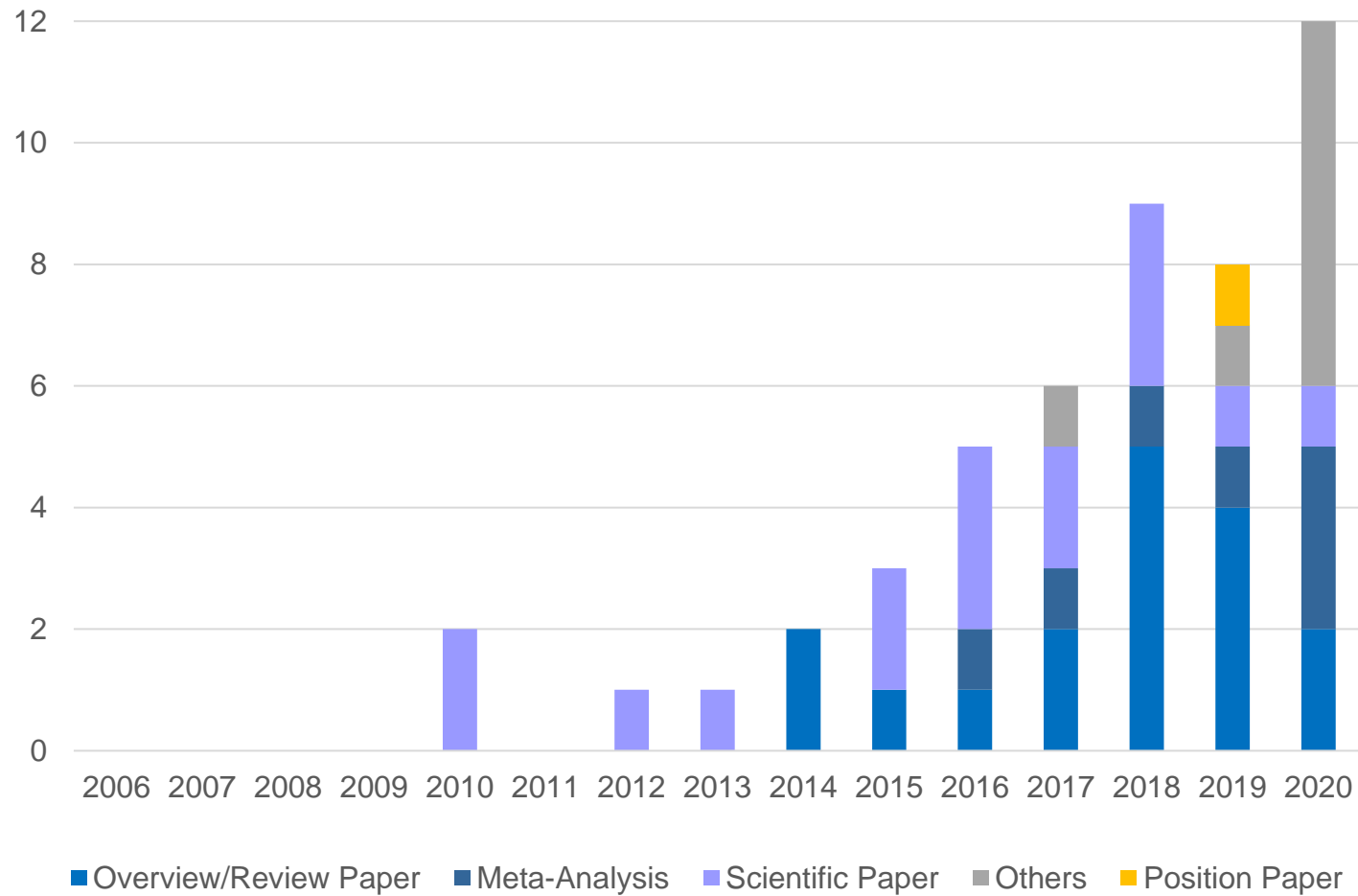
Hansjörg Lerchenmüller
Business Angel & Advisor

- Environmental entrepreneur
- Multiple Entrepreneur
- founder/CEO of a high-tech company (solar energy)
- 25 years of experience in the commercialisation of new technologies

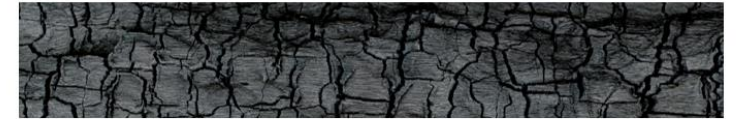
- Hansjörg Lerchenmüller is Chairman of the [European Biochar Industry Consortium e.V.](#)
- Investor and supervisory board at [Carbuna AG](#), a leading producer of biochar-based products for agriculture
- Co-Founder and investor in [carbonfuture GmbH](#), operator of a transaction platform for carbon sinks

EBI Whitepaper Okt 2020

Analysis of bibliography



EBI Whitepaper
Biochar-based carbon sinks to mitigate
climate change



October 2020

Twelve good reasons for using biochar

The arguments can be scientifically well substantiated by current literature

#	Twelve good reasons for using biochar	Sources/Documents
1	Biomass pyrolysis is a key technology for saving the climate	(Werner et al, 2018; Woolf et al, 2010; Woolf et al, 2016)
2	The use of certified biochar has been proven to meet the highest environmental standards and, when used properly, is safe for soils, ecosystems and users	(EBC, 2020; Lehmann & Joseph, 2015)
3	Pyrolysis can be used to close organic material cycles. This is a prerequisite for the principle of recycling in the bio-economy.	(Woolf et al, 2016)
4	Biochar improves the water retention capacity of soils and, in combination with fertilizers, leads to yield increase and stabilization	(Ye et al, 2020; Razzaghi et al, 2020)
5	Biochar helps to build up humus	(Blanco-Canqui et al, 2020; Weng et al. 2018)
6	Biochar reduces GHG emissions from agriculture	(Borchard et al, 2019; He et al, 2017; Liu et al, 2018)

Twelve good reasons for using biochar

The arguments can be scientifically well substantiated by current literature

#	Twelve good reasons for using biochar	Sources/Documents
7	Biochar reduces nitrate pollution of ground and surface water	(Borchard et al, 2019)
8	Biochar shows multiple benefits in animal husbandry and improves animal health	(Schmidt et al, 2019)
9	Biochar promotes tree growth and increases the stress resistance of urban trees	(Embrén et al, 2016; FLL, 2017)
10	Biochar can be used as an additive in composting to improve compost quality and reduce nitrogen losses	(Godlewska et al, 2017; Zhao et al, 2020)
11	Biochar can improve the properties of concrete and asphalt	(Gupta & Kua, 2017)
12	Biochar enables the rehabilitation of contaminated soils	(BMLFUW, 2017)