

minus CO2  
by carbonauten



CO2 – from waste to value

# minus CO2 by carbonauten



CO2 - the more of it used as material in products, the better for the environment, people and companies

# minus CO2

## by carbonauten

**carbonauten has developed a unique system for industry that is immediately effective in reducing their CO2 emissions and costs.**

The carbonauten system involves the production of a category of materials that is innovative in many aspects

**NET Materials® (Negative Emission Technology)**

The NET Materials® consist of the combination of biocarbons and / or green chalk with different binders.

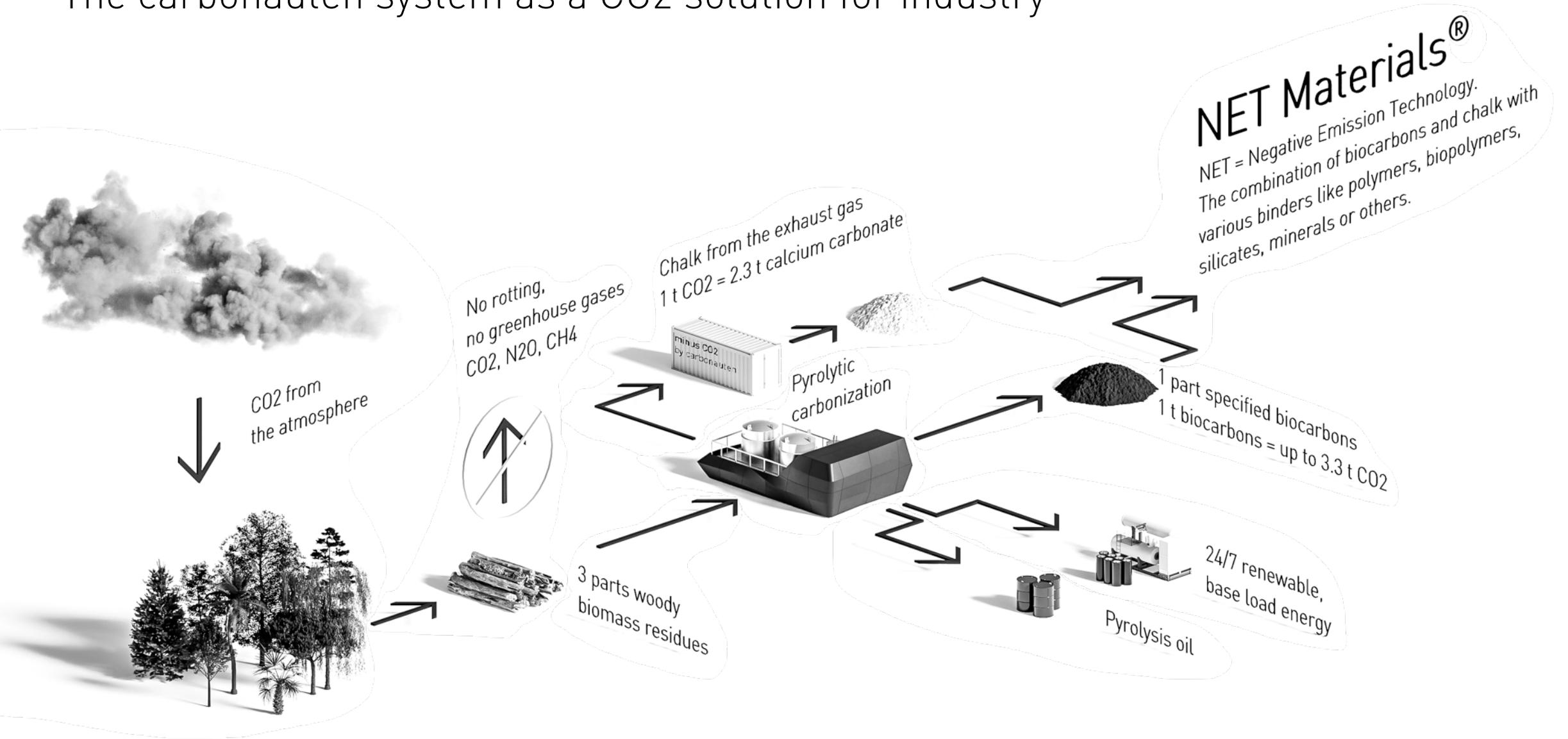
The biocarbons are produced from biogenic and industrial residues by pyrolytic carbonization. Each ton of biocarbon stores up to 3.3 tons of CO2. The CaCO3 is extracted from industrial waste gases. 1 ton of CO2 becomes 2.3 tons of CaCO3 (chalk).

Scaling is ensured by worldwide, decentralized and technologically identical sites.

carbonauten plan to reduce climate gases by at least one gigatonne per year in 2030 by operating 200 sites worldwide and replacing large quantities of petroleum-based plastics, building materials, agricultural chemicals and fossil fuels.

This will result in sales of at least €2 billion.

# The carbonauten system as a CO2 solution for industry



# Examples of biomass residues and waste (lumpy)



Saw residues



Wood chips



Nutshells, press remnants, seeds



Bamboo, Miscanthus



Green cuttings, screen overflow



Waste wood A1 - A4



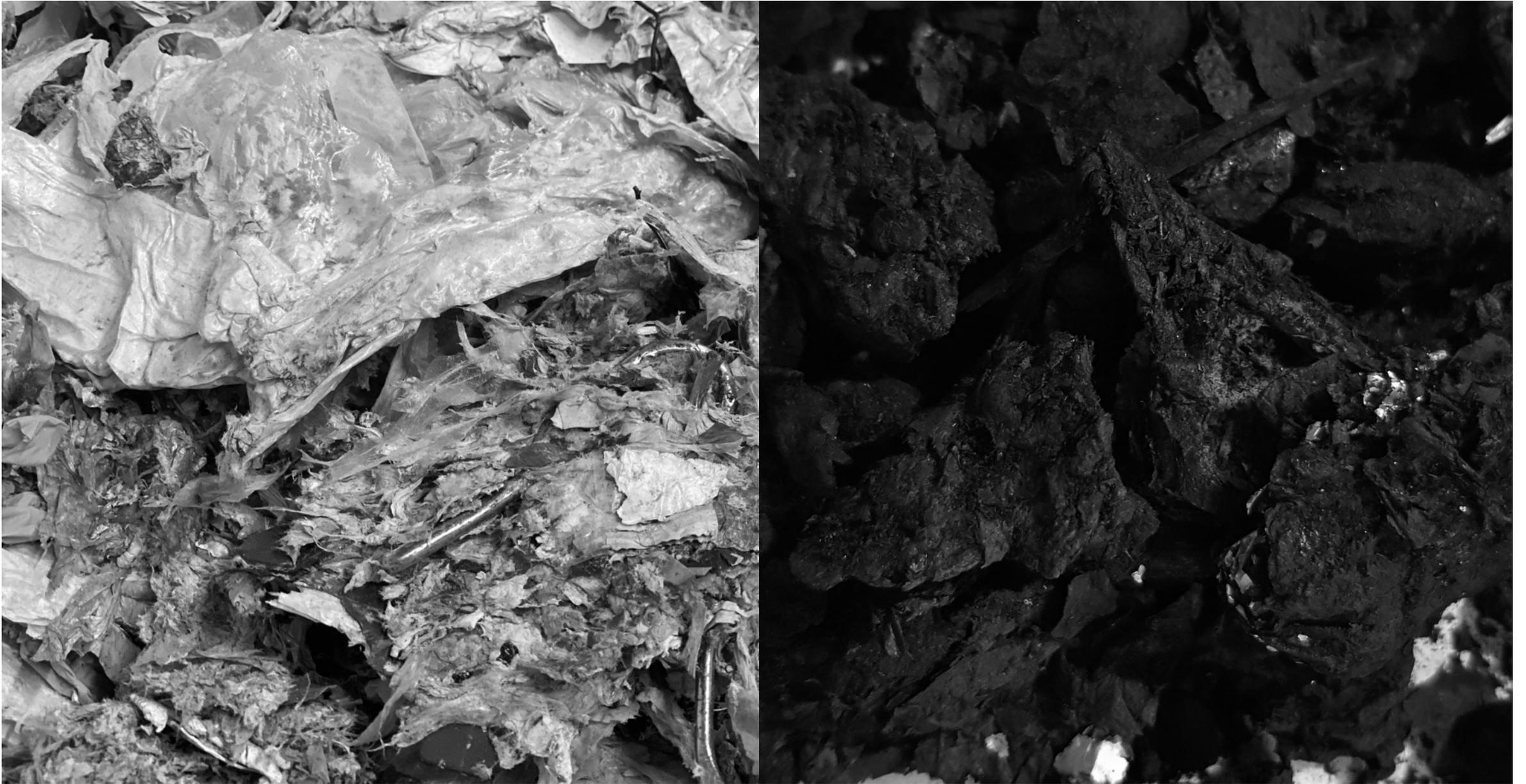
Paper Reject



Paper Sludge



Problematic wastestreams: Recarbonization of screen overflow (made in the laboratory)



Problematic wastestreams: Recarbonization of Paper Reject / plastic waste „Carbon to Carbon“ (made in the laboratory)

# Disruption!

**carbonauten NET Materials® simply solves the dilemma between ecology and economy.**

The more products that are made from carbonauten NET Materials®, the

- better it is for the environment,
- better the image for the producer (USP)
- higher turnover and profit for the producer

After use they are

- Biodegradable
- Recyclable
- Recarbonisable

Exemplary target markets are

- Construction industry
- Plastics industry
- Automotive industry
- Transport industry
- Energy industry
- Heavy industry
- ...

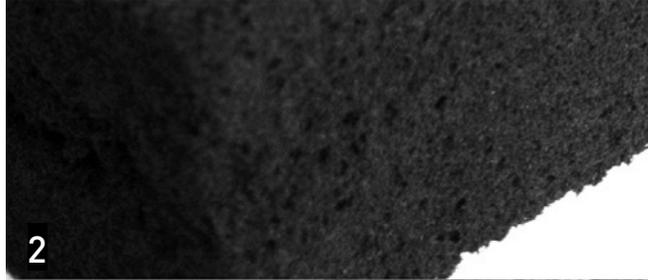


# Proof of concept NET Materials®

- 1 Biocoke from waste wood
- 2 Foam (insulation, lightweight, padding, filtration)
- 3 Extruded sleeves and caps
- 4 Thermoplastic granules
- 5 Injection molded test bars for DAIMLER made of PP C30
- 6 Injection molded shell
- 7 Green chalk
- 8 biodegradable plantpot
- 9 Wall element (sandwich MgO<sub>2</sub>/foam/MgO<sub>2</sub>)
- 10 Plate (biocarbon/silicate, curing with CO<sub>2</sub>!)

## Example for plastics in the automotive industry

Reduction of GWP 20 of polypropylene when replaced by NET materials® from +2.67 kg CO<sub>2</sub> to -0.47 kg CO<sub>2</sub> per kg injection molding material (calculation DAIMLER/Steinbeiss)



# Technical centre, prototype

It is the logical further development of a proven batch retort system with over 100 installations worldwide. For the first time, the biomasses are heated directly.



# Carbonisation technology

For scaling via decentralised systems, an investment of between € 3 - 5 million is required per location for at least 3 modules.

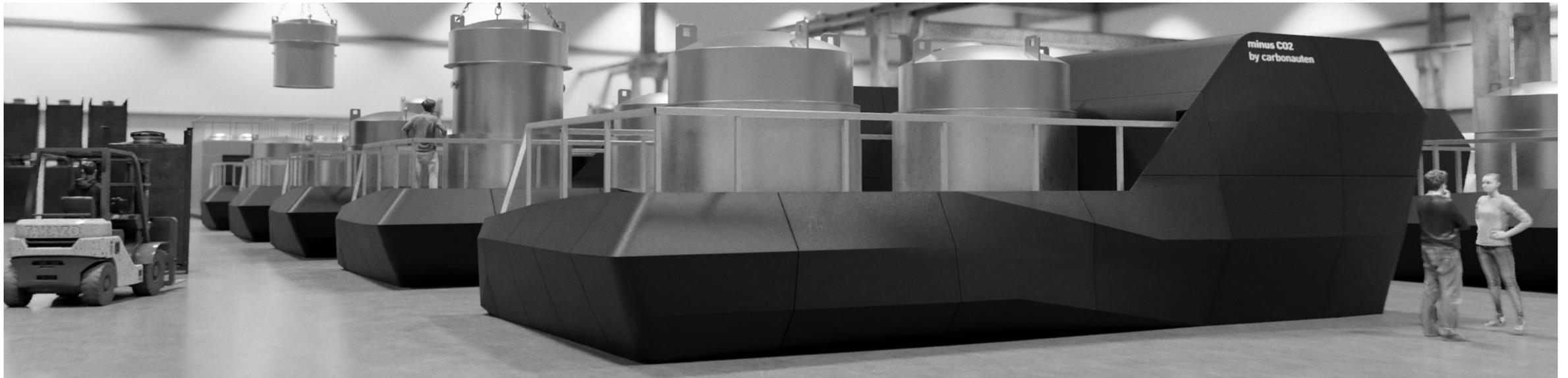
## Special features

- Modular and transportable
- Can be used for a wide range of biomasses
- Robust (no rotating parts)
- High product quality (direct heating 450° - 700°C)
- Continuous operation 24/7, at least 8,000 hours/year
- Excellent energy balance (1 MWth waste heat)

Annual output of three modules (average site)  
> 5,000 t biocarbons  
> 24 GWh thermal (850° C) surplus energy  
> 15,000 t CO2 credits

## Prerequisite

- 15,000 t biomass dry residues/waste
- 1,000 m<sup>2</sup> production hall with 10 m height
- 3,-4,000 m<sup>2</sup> storage area
- Permission



# minus CO2 plant in industrial dimensions

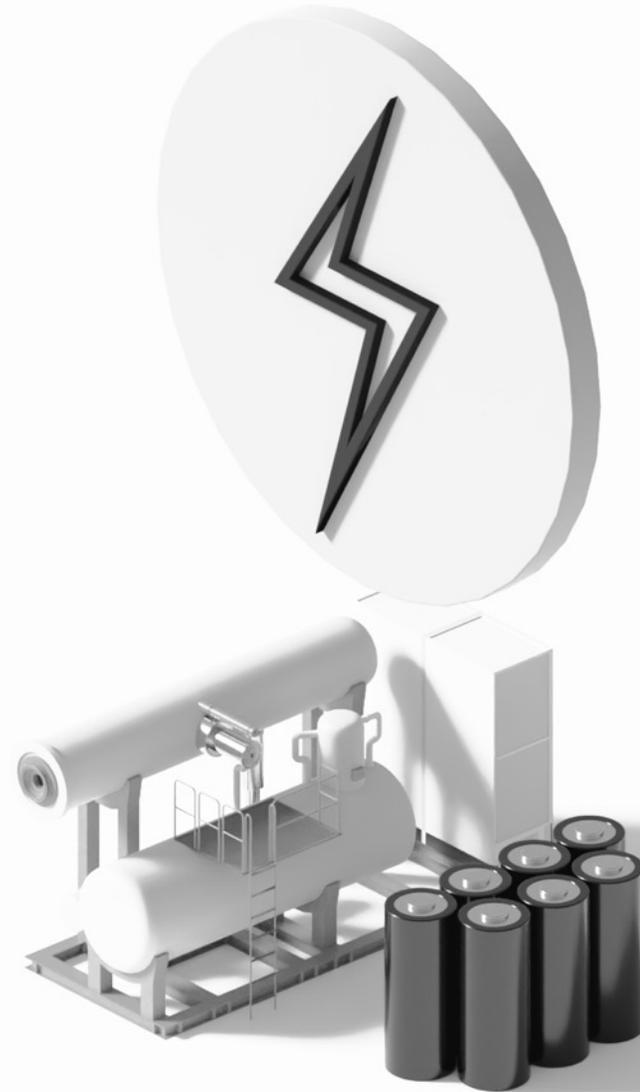


20 carbonisation modules: > 32.000 t biocarbons, 160 GWh thermal, 100.000 t carbon credits, > 1.600.000 l pyrolysis oil, > 100.000 t NET Materials®

# Bioenergy power plant 2.0

Combining surplus baseload heat and electricity, with the benefits of bioenergy and PV/wind energy through syngas.

- Base loadable renewable energy
- Free fuel
- Independence from input



# carbonauten USP is a unique triad

- NET Materials®
- Biocarbon database
- Carbonisation technology with low-cost energy production

# Sources of income

- Biocarbons
- carbonauten NET Materials®
- Bio energy
- Pyrolysis oil
- CO2 certificates (a basic plant generates certificates for 150,000 t CO2 in 10 years. This can be used to finance a site)

# carbonauten marktorientierte Struktur

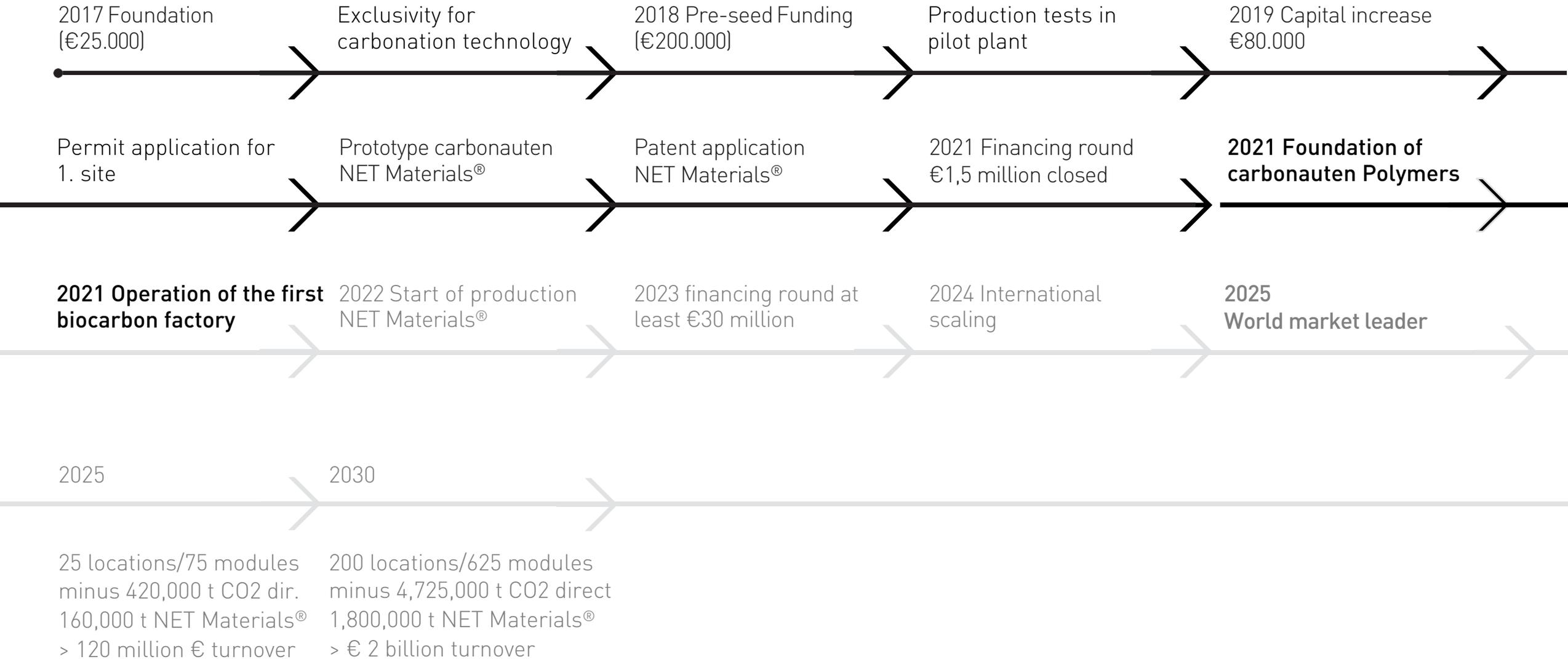
Expertise for respective target markets and industries  
and expansion of value creation at production sites.

Parent company: carbonauten GmbH (production sites for biocarbons, lime, energy, etc.)

Subsidiaries minus CO2 by

- carbonauten polymers (currently being founded)
- carbonauten construction
- carbonauten agroforestry
- carbonauten heavy industries
- carbonauten energy

# Roadmap to World Market Leader



minus CO2 by...

**ForestFinance**  
Wir machen Wald. — EST. 1995 —

**VOITH**



*leipa*

*wepa*



**SONY**

**B/S/H/**  
BOSCH AND SIEMENS HOME APPLIANCES GROUP



**ZÜBLIN STRABAG**



— **EnBW**

minus CO2 by...



The three colleagues from the carbonauten polymers are missing.