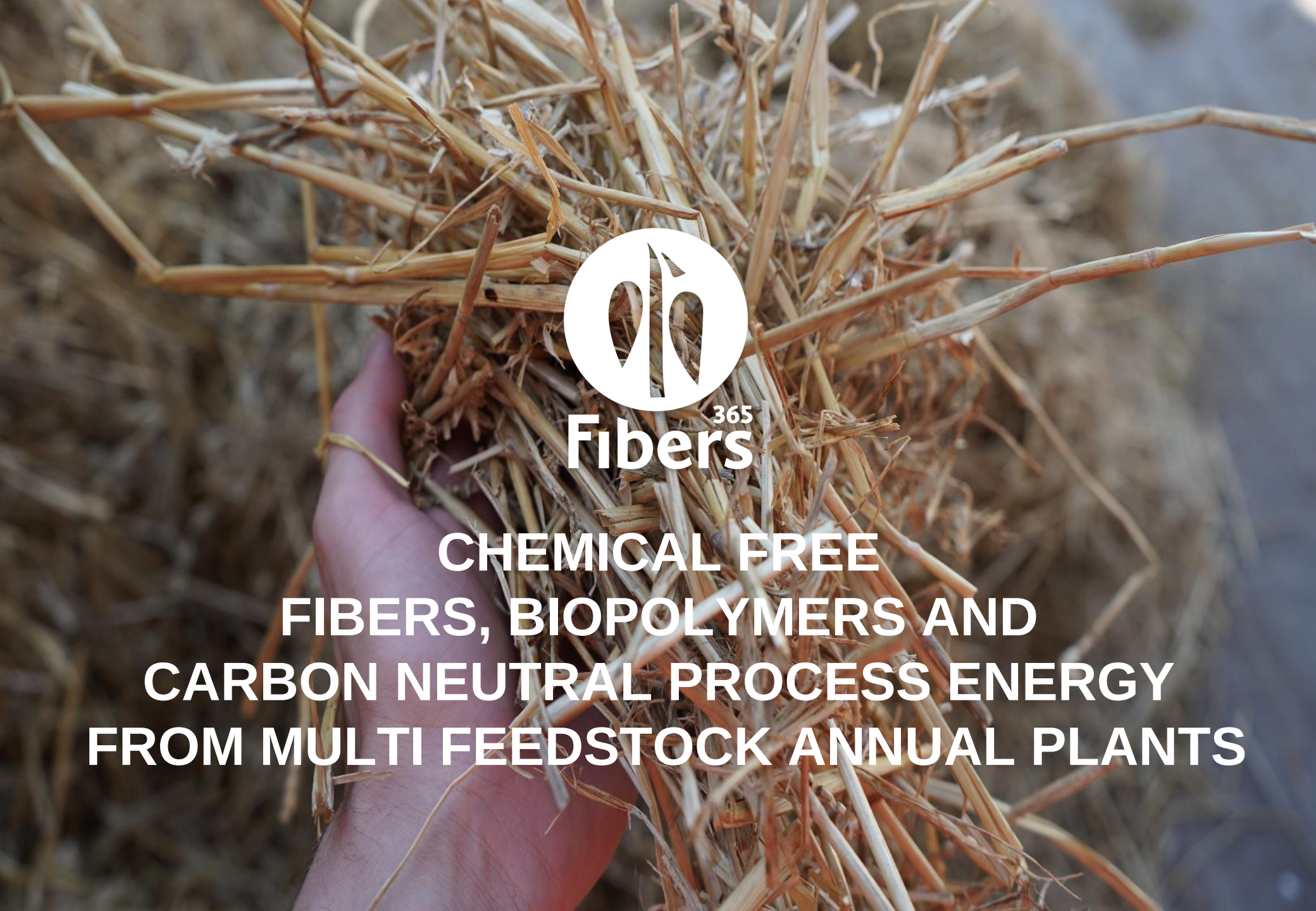

365
Fibers
CHEMICAL FREE
FIBERS, BIOPOLYMERS AND
CARBON NEUTRAL PROCESS ENERGY
FROM MULTI FEEDSTOCK ANNUAL PLANTS

# Why annual plants? Huge potential for long term carbon fixation with short carbon loops for process energy

**Carbon Cycles**

| | |
|---|---|
| Fibers365 / annual biomass | < 1 year |
| Tropical monoculture wood plantation | 7 to 10 years |
| Natural woods | 60 to 120 years |
| Fossile polymer and energy sources | ∞ ∞ ∞ |

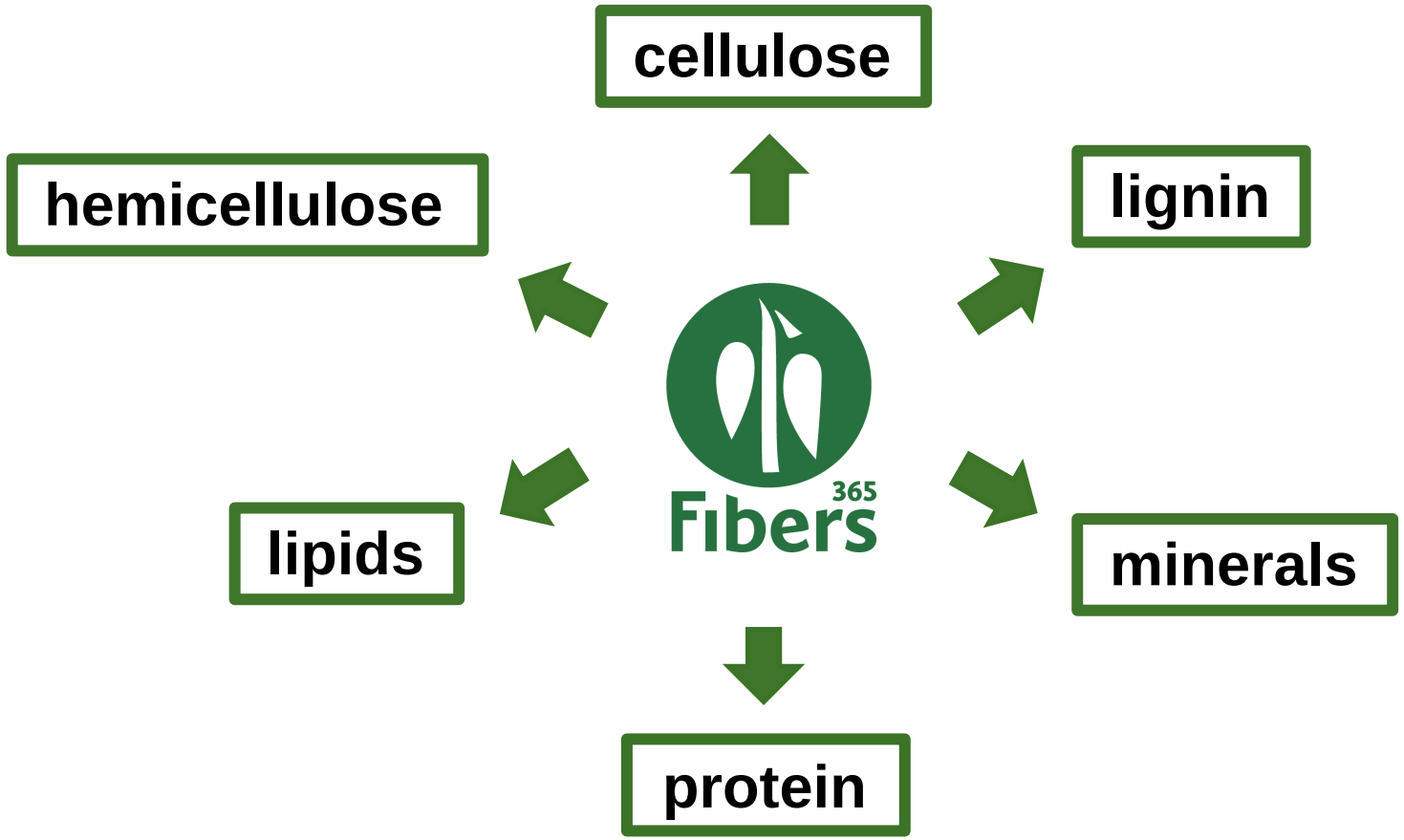
**Fibers365 concept benefits**

Fibers365 feedstocks offer raw material for long term carbon fixation at the same time as they offer a short term (< 1 year) carbon loop for all processing energy

- ✓ Immediate and massive potential to contribute to short and long term climate goals
- ✓ Maintain forest carbon sinks and biodiversity
- ✓ Minimal water footprint
- ✓ Low carbon footprint allocation for planting and harvesting: distributed between food and feedstock

# The challenge:

## …make annual biomass competitive through 100 % value creation




## …after food production!

# The Fibers365 solution:
## ...the multi-feedstock modular Steam Fiber Process

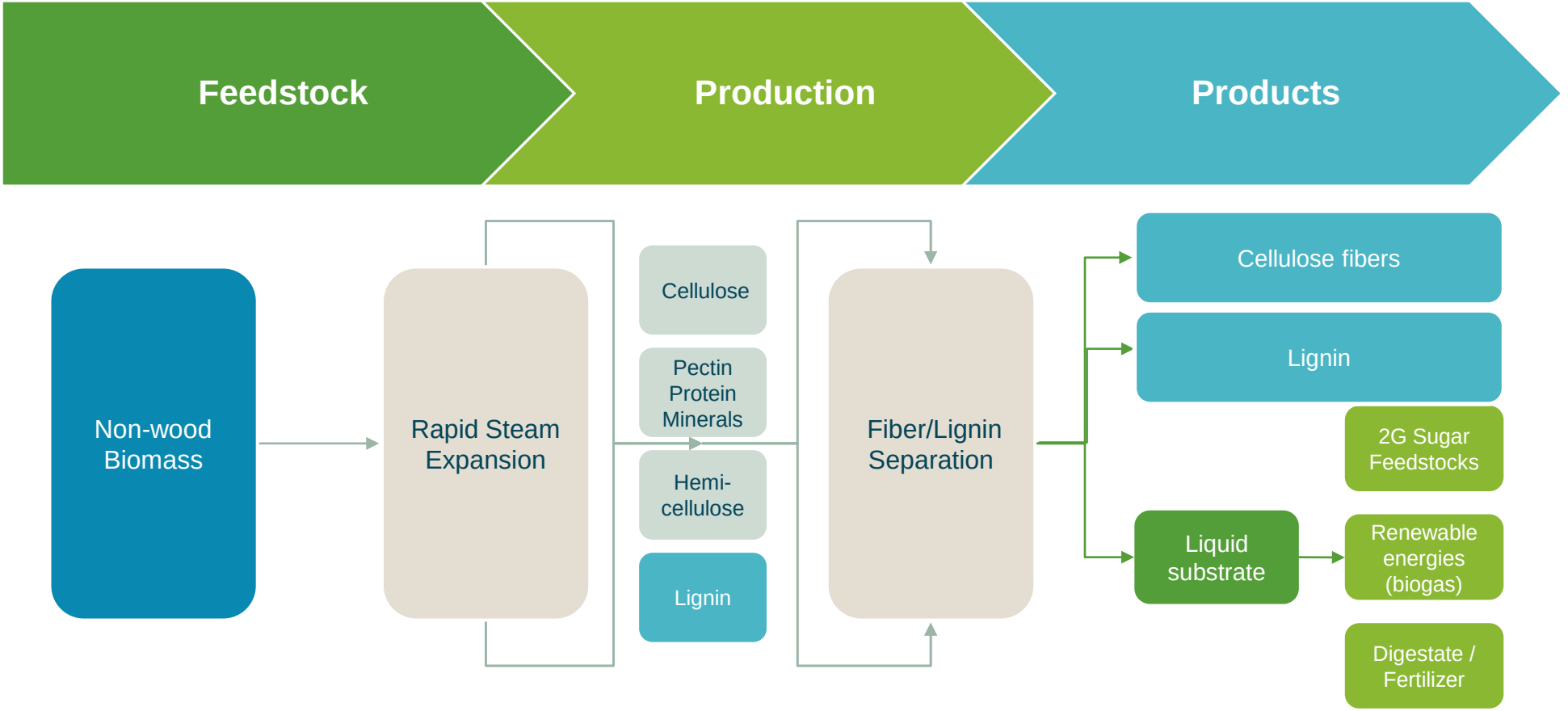









# …a chemical free two step integrated process:



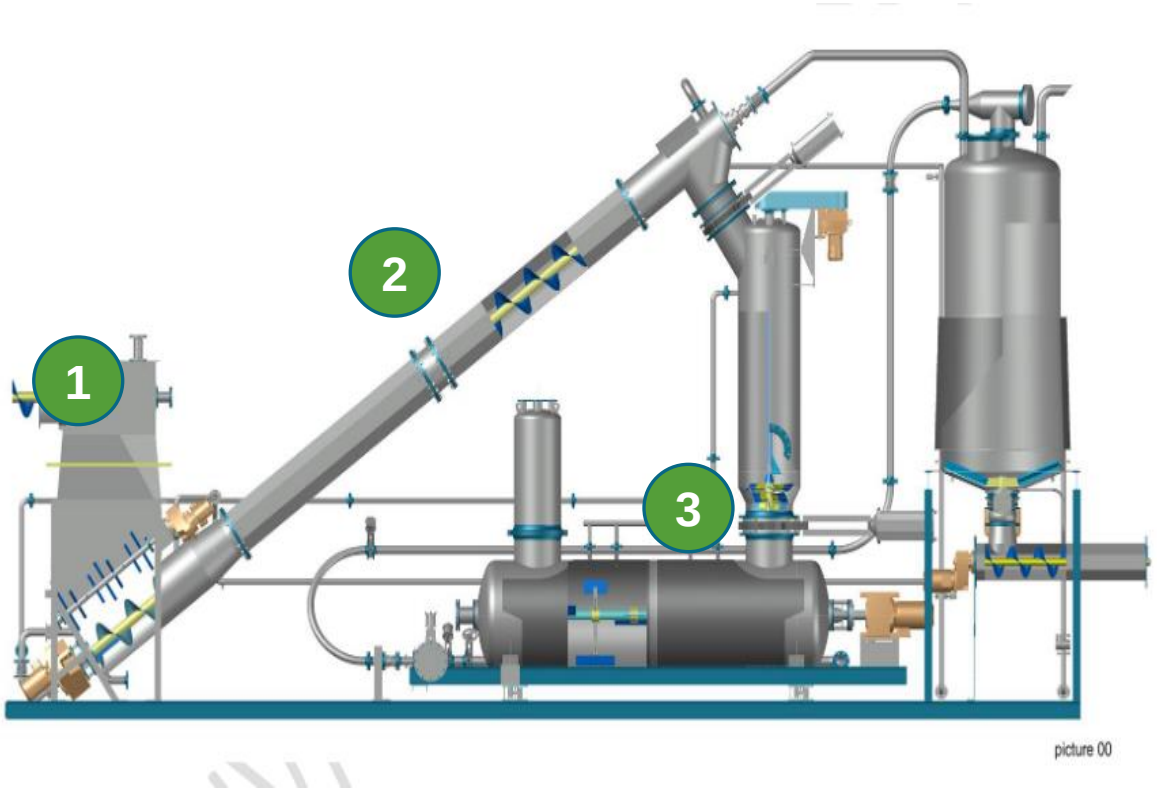

**Fibers365's value chain is based on separate, patented modules for pulping and fractioning of non-wood biomass:**

✓ The **Rapid Steam Expansion Module** uses a patented technology for rapid steam expansion to pulp lignocellulosic non-wood biomass

✓ The **Fiber/Lignin Separation Module** separates fibers and lignin from liquid substrate for biogas and second gneration sugar (patent pending)

# The Fibers365 Rapid Steam Expansion technology

**Continuous, energy efficient, chemical-free non wood biomass processing through the RSE rapid steam expansion process requiring no external steam source**




**Process overview**

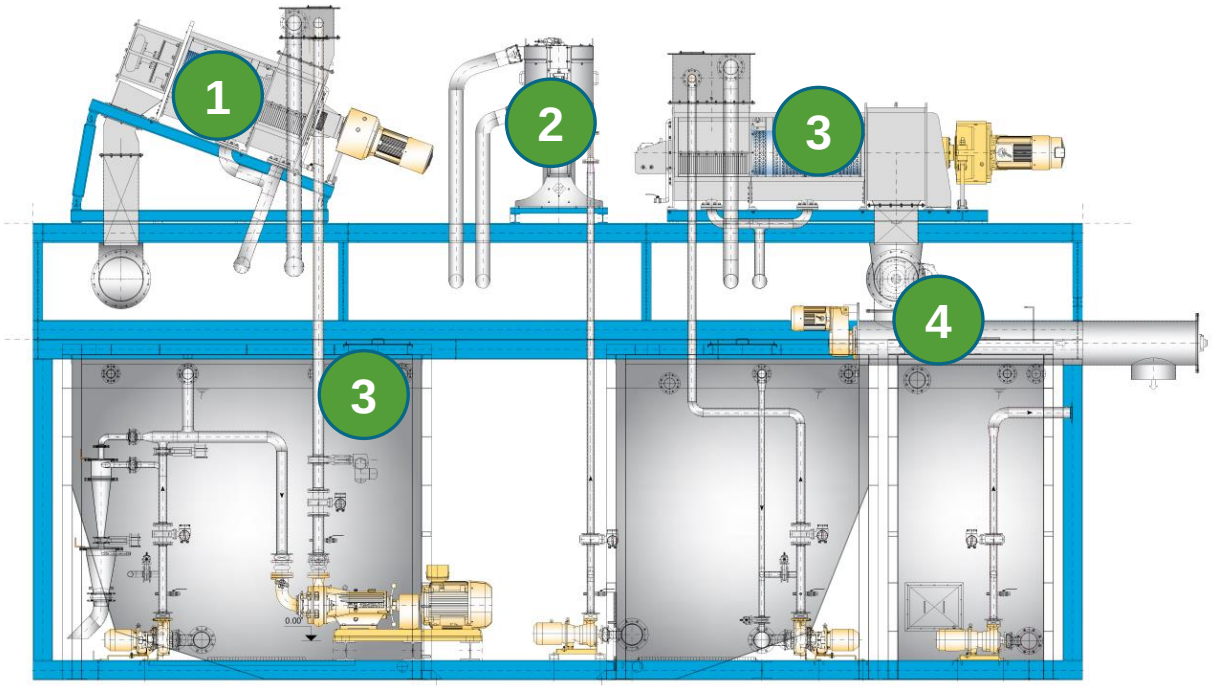
1. **Wetting of shortened biomass**

2. **Preheating with recycled flash steam**
= reducing energy demand by 50%

3. **Thermo-pressure-hydrolysis in a steam cooker**
The resulting product is a chemical free fibrous slurry, allowing further processing

# …plus the Fibers365 multi-stream product separation

**The Agrowfiber SE allows to separate the chemical free fibrous slurry after the Economizer stage into cellulose fibers, lignin, 2G feedstock and biogas substrate**




**Process overview**

1

**Hemicellulose separation**
Diluted sugars and organic acids are washed off and filtered from the fibrous slurry

2

**Lignin precipitation and separation**
Lignin is separated and concentrated from loaded washing waters by microfiltration

3

**Fiber purification, deflaking and dewatering**
Pre-washed fibers are pulped, mechanically de-flaked, dewatered and pressed into bales

4

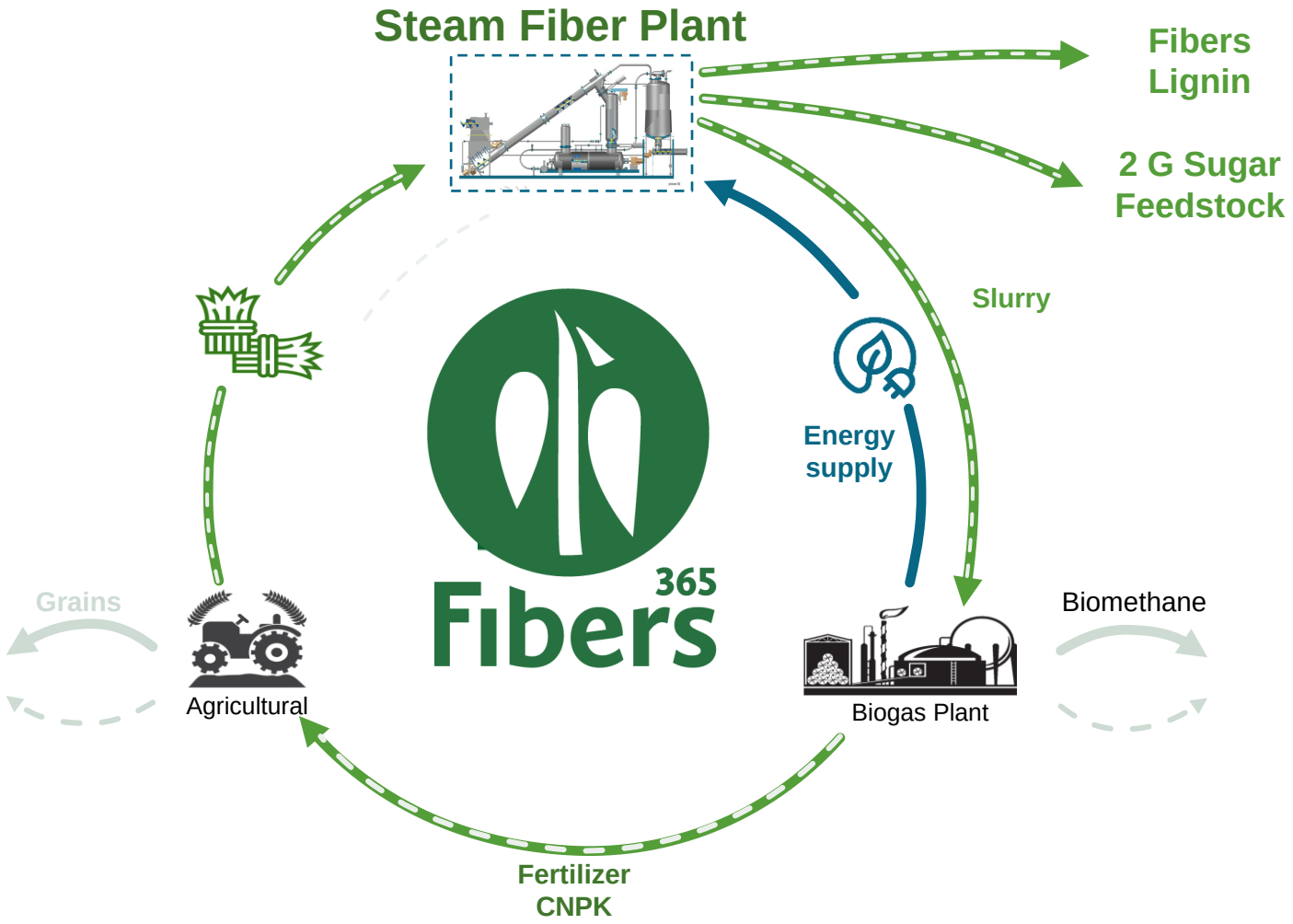
**Slurry Separation**
The remaining organic matter serves as 2G sugar feedstock for biopolymers or as a energy rich substrate for bioenergy production in a biogas plant. Remaining organic matter after biogas production closes the soil fertility loop on the fields with valuable nutrients

# …and the Fibers365 bioeconomy approach

## . . .create carbon and soil fertility loops through distributed, farm-level processing

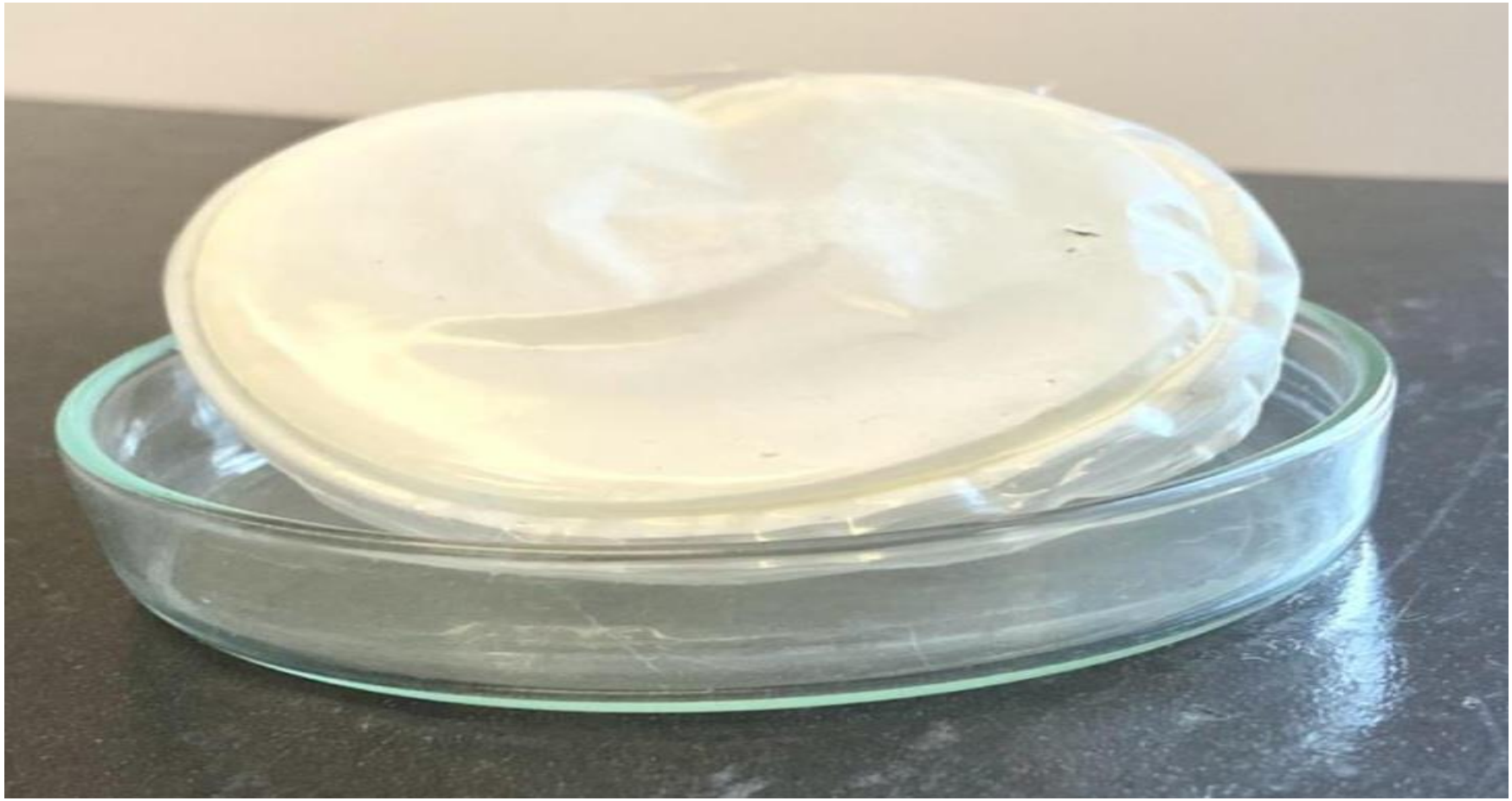
**Key takeaways**

- ✓ Use annually regrown biomass as the source for carbon neutral fibers, biopolymers and process energy in a one year carbon loop
- ✓ Stay chemical free, allowing a soil fertility loop through a zero waste production process
- ✓ Integrate raw material supply and production in existing supply chains
- ✓ Access multiple, regional feedstocks, from straws to tropical fibers
- ✓ Keep CAPEX and OPEX competitive through a cascading value chain and integration in existing infrastructure



# Fibers365 multiple feedstocks, multiple applications…

# PHA production from Fibers365 2 G sugar substrates



# Dynamic Fibers365 markets

## Natural Fiber Markets (Paper Packaging, Fiber Forming, Composites,Textiles)

- ✓ Chemical free fibers[365] allow truly sustainable f(ood) packaging and textile products
  - ✓ Up to 100 % steam exploded fibers[365] in paper grammages from 20 to 600 gsm for tissue and packaging is possible and market proven, at current non wood fiber prices > 1200 €/ton
  - ✓ Fiber forming applications with 100 % fibers[365] require no additional binders or virgin wood fibers
  - ✓ Relevant fractions are suitable for further textile fiber processing, without sacrificing value creation from non-suitable biomass (and usually chemically polluted fractions

## Lignin and 2 G Sugar Feedstock for Biopolymers and Lipids (for multiple industrial and civi applications)

- ✓ At prices ranging from > 2,000 to 5,000 €/ton, sulphate free, natural lignin is a highly profitable product line
- ✓ With Fibers365 technology, lignin is already available from the core process as a natural residual by-product while producing fibers.
- ✓ Chemical free pulping allows also for encymatic bio processing down streams from hemicellulose, sugars and acids at competitive costs

## Energy Market (Biogas)

- ✓ Over 14,000 biogas plants worldwide present a considerable opportunity for Fibers365 through enhanced farm level value creation not existing in current biogas installations
- ✓ Fibers365 liquid substrate sidestream from fiber production increases total biomass throughput capacity per plant
- ✓ Fibers365 makes any dry non wood biomass accessible for biogas production

# Fibers365 USPs

## Fibers365's concept …

✓ Fibers365 concept permits the use of **multiple biomass sources** (straw, efb, miscanthus, napier grass, banana stems, tomato stems, grapevine stems, cup plant etc.), which ensures **significant volumes of available cost effective feedstock**

✓ **Modular** steam explosion technology allows for smaller units in a network, decentralizing the value chain and allowing for cost competitive non wood biomass processing compared to large wood and non wood biomass refineries

✓ The concept benefits from a **cascade utilization of agricultural materials** (food, fiber, energy and fertilizer production)

✓ The concept takes advantage of **an already existing supply chain and infrastructure CAPEX** at biogas plants, with short transport distances for raw material and fertilizer streams

## … offers a cost-effective, sustainable solution compared to chemical processing

✓ Regional, chemical free processing allows **easy return of remaining carbon matter** for soil carbon fixation, instead of (polluted) remaining carbon matter incineration and corresponding $CO_2$ emissions in centralized refineries for energy production and waste stream management

✓ A tonne of steam exploded fiber from non-wood crops for paper or biogas production may be **processed at full cost (CAPEX, OPEX) at competitive rates** to virgin wood pulp and other non-wood pulp

✓ Revenue streams from **non-polluted lignin and second generation sugars** for additional contribution margins, while avoiding all **disposal costs for polluted waste streams**

# Fibers365 team, facilities and partners

**Fibers365 GmbH is a technology start up based in Lenningen, Germany, founded and managed by the owners of Silphie Paper GmbH (Germany) and AGRES Systems GmbH (Austria) with a strong focus on technology and product development as well as R&D**

| | |
|---|---|
| **Fibers365 team** | Our technology, business development and R&D Teams with a joint head count of 30 and multiple academic research partnerships work in dedicated and fully equipped non-wood fiber and substrate R&D facilities in Lenningen and Parndorf (Austria) and our R&D pipeline for the next years is filled with several high impact initiatives |
| **Fibers365 facilities** | Our facilities include mechanical and electrical workshops, analytical laboratories, a steam explosion test line, a biogas plant, a paper/non woven machine, a barrier coating test line and the Packaging Campus Lenningen with relevant printing, folding and cutting equipment for continuous R&D and quality assurance efforts for product and technology development |
| **Fibers365 R&D partners** | **HdM Hochschule der Medien Stuttgart (Packaging Technology), University Hohenheim (Agriculture), University Stuttgart (Institutes for Microbiology and Bio Process Engineering, Institute for Plastics and Process Engineering KIT), University Reutlingen (Textile and Design), DITF Denkendorf (Industrial Textiles), European and Global Industrial Partners** |
| **Fibers365 tech partners** | Agres Systems GmbH, Silphie Paper GmbH, Phoenix Non Woven GmbH & Co KG, PTS Germany |

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# THANK YOU FOR YOUR INTEREST!

Fibers 365

**Fibers, Lignin, Biopolymers and Bioenergy from Annual Plants**

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