



Novel Functional and Technical Fibres - Sustainable through renewable carbon strategy

Intexcon 2025, Ahmedabad/India, October 7th 2025

Prof. Prof. Dr. Thomas Gries

The background is a solid green color with a fine, woven texture, similar to a book cover or a piece of fabric. Overlaid on this texture is a faint, large-scale geometric pattern consisting of several overlapping triangles and quadrilaterals in a slightly darker shade of green, creating a subtle architectural or crystalline effect.

The big 3 Transformations

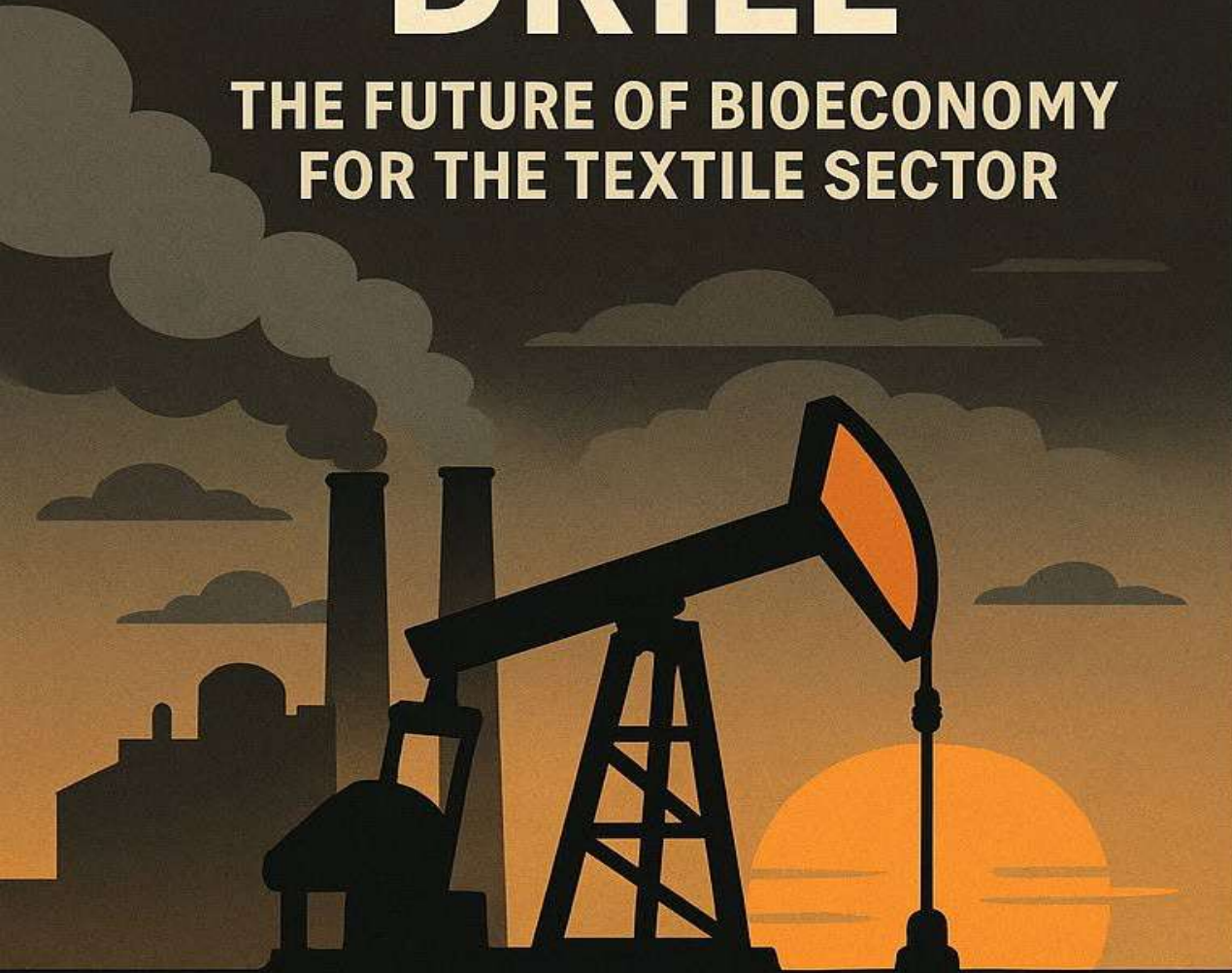


**The industry sectors are facing
3 radical transformations in 1 decade**

- **Industrial Transformation**
- **Sustainability and Defossilisation**
- **Digitalisation and Automation**

DRILL, BABY, DRILL

THE FUTURE OF BIOECONOMY
FOR THE TEXTILE SECTOR

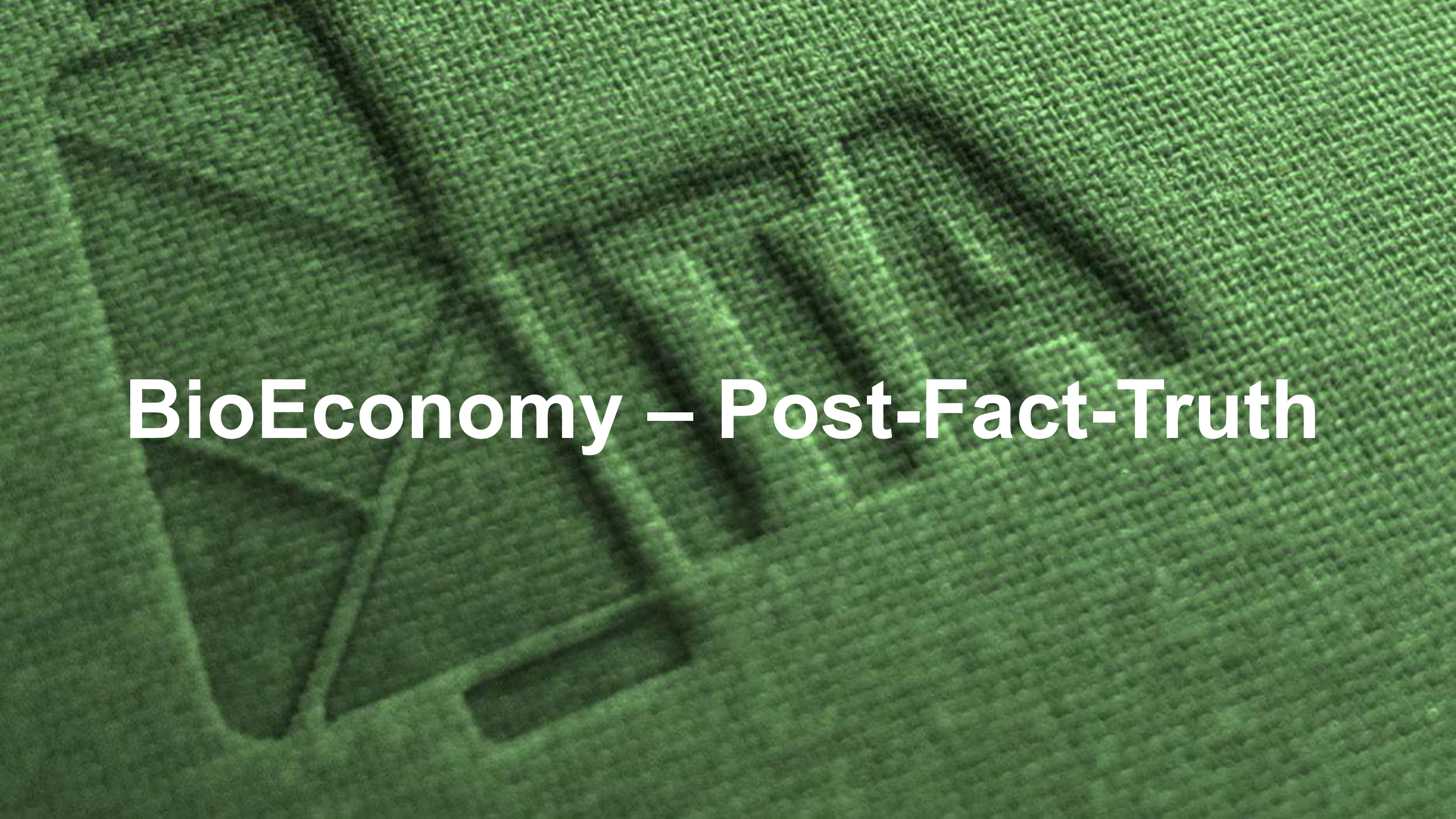


GROW, BABY GROW

THE FUTURE OF BIOECONOMY
FOR THE TEXTILE SECTOR



Thomas Gries, Ahmedabad/India 2025

The background is a vibrant green with a fine, woven texture. Overlaid on this texture is a faint, embossed image of a microscope, showing its eyepiece, objective lenses, and base. The text is centered horizontally and vertically over the image.

BioEconomy – Post-Fact-Truth

**"WE'LL DRILL,
BABY, DRILL"**



A medium shot of Jair Bolsonaro, President of Brazil, speaking. He is wearing a dark suit, a light blue shirt, and a striped tie. He has short, graying hair and is wearing glasses. He is looking slightly to the right of the camera with a serious expression. In the background, two Brazilian flags are visible, partially obscured by a dark vertical element. The lighting is soft and even.

Jair Bolsonaro
Presidente del Brasile

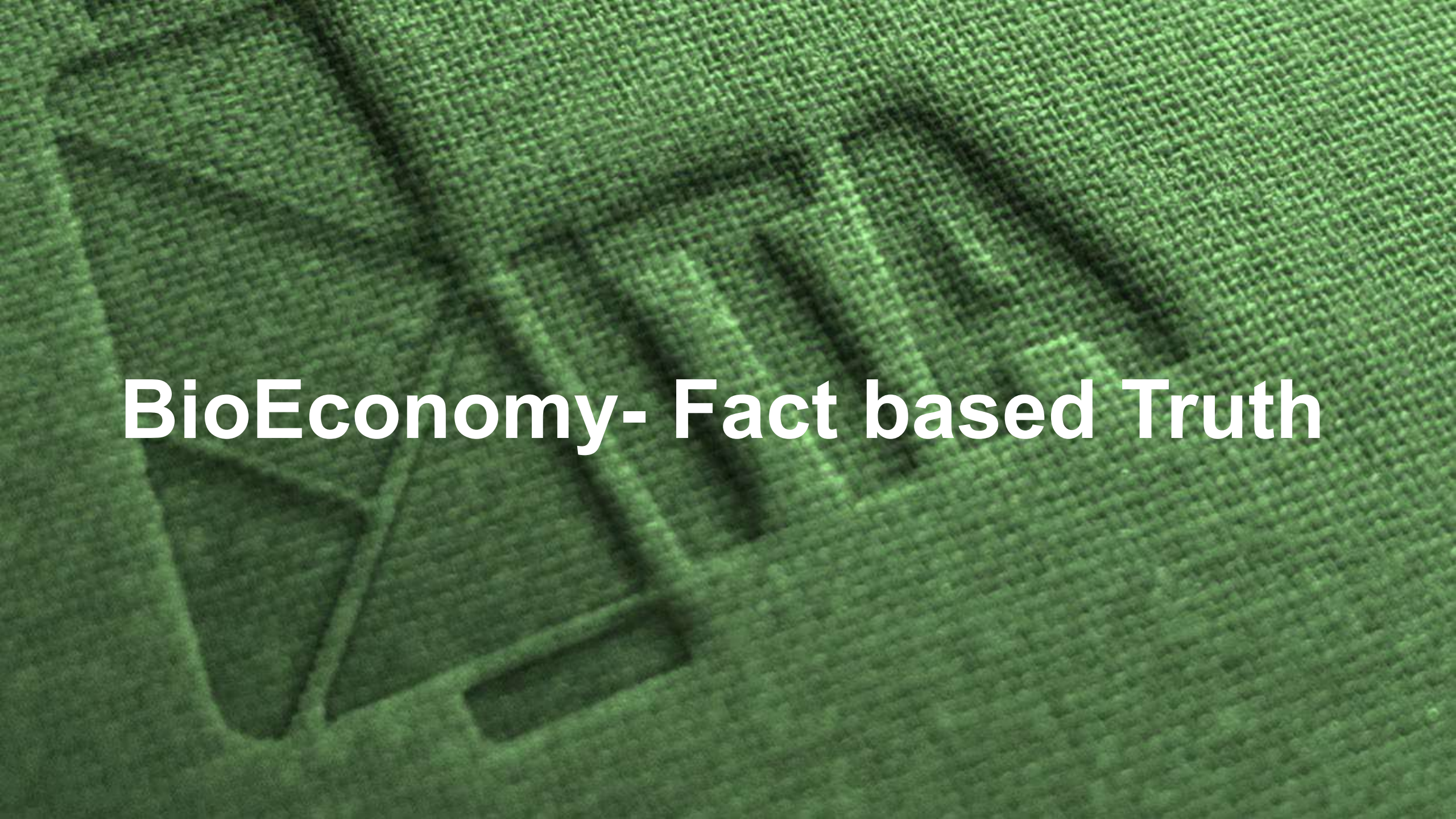
La foresta amazzonica è una parte
fondamentale della nostra storia

A photograph of Alice Weidel, a member of the AfD, speaking at a podium. She is wearing a dark blazer over a white shirt and a pearl necklace. She is gesturing with her right hand, pointing upwards. The podium has a blue banner with the text "ZEIT FÜR DEUTSCHLAND." and the AfD logo. The background is a blue wall with the AfD logo and the text "ZEIT FÜR DEUTSCHLAND." repeated.

Alice Weidel, AfD:

There is no Climate Change!

We will tear the Wind Mills down!

A close-up, high-magnification image of a green, textured surface, likely a biological specimen, viewed through a microscope. The texture is highly detailed, showing a fine, woven pattern. The lighting is bright, creating a strong contrast between the green and the white text.

BioEconomy- Fact based Truth

MAKE THE SDGS A REALITY

Discover The Goals ↓



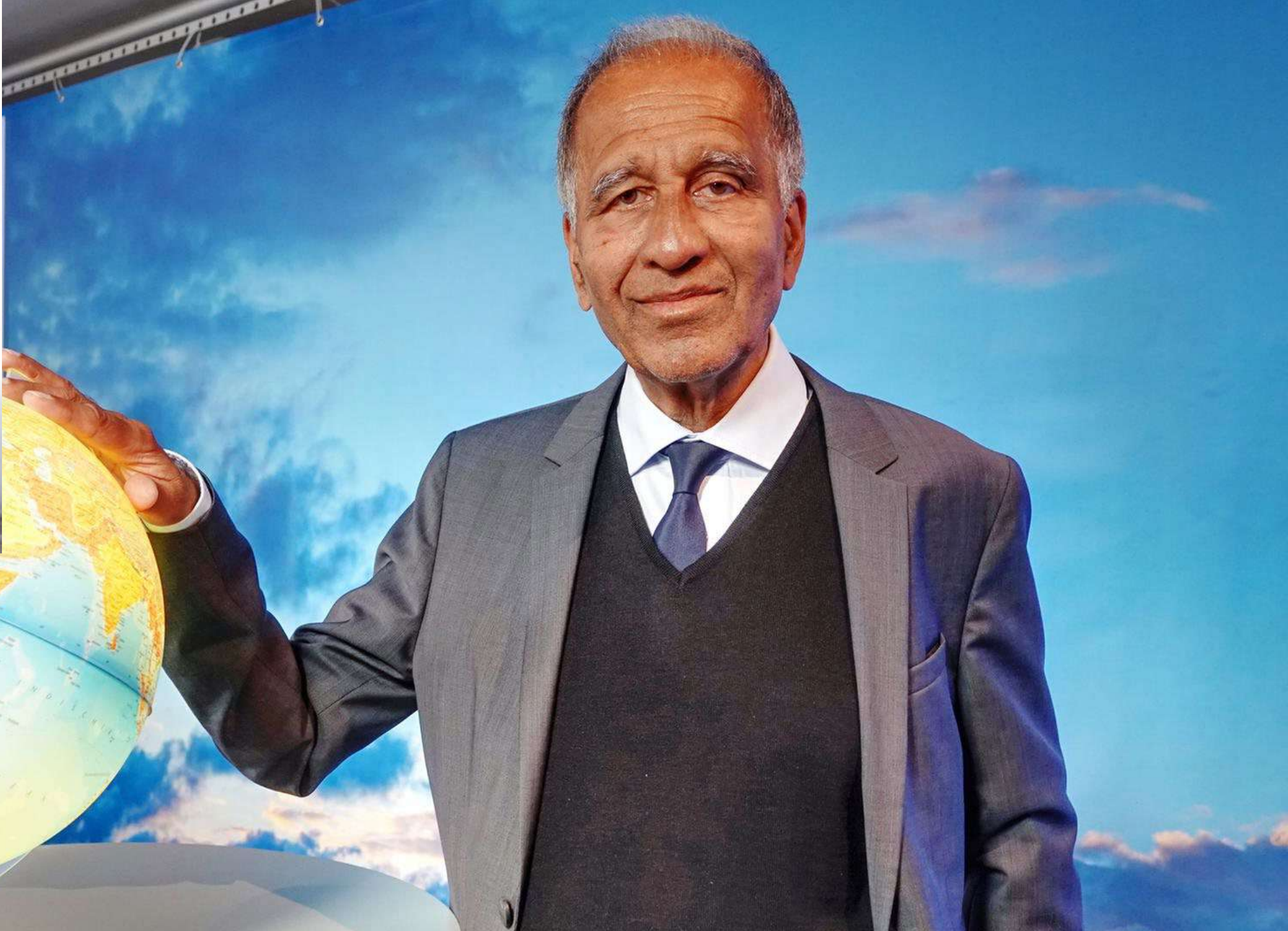
THE SUSTAINABILITY PROJECT



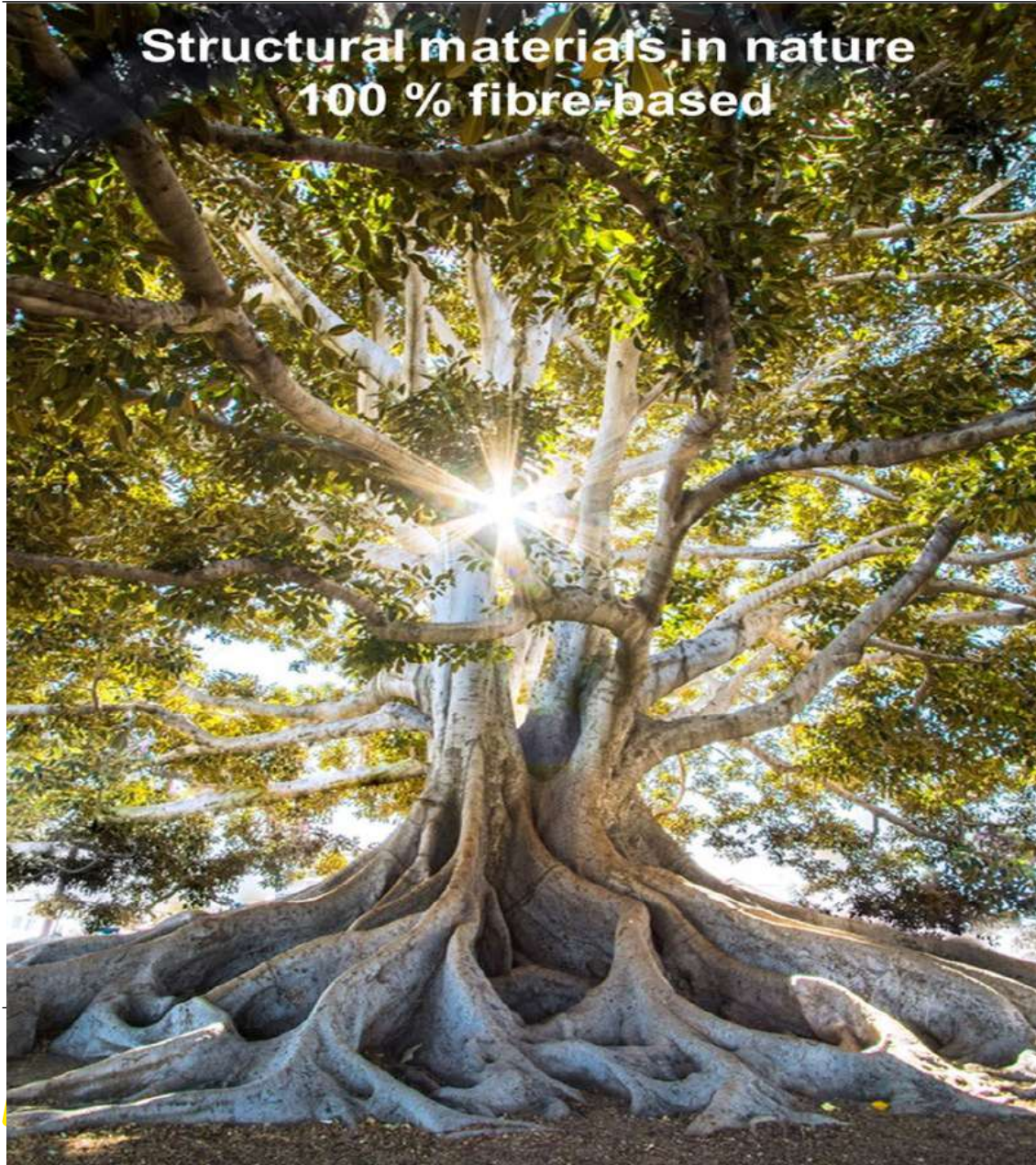
Mojib Latif

CLIMATE CHANGE

The Point of No Return

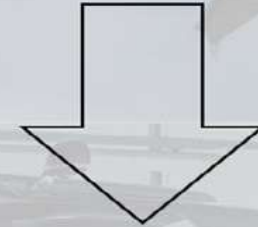


Textile? Textile. Textile! Potential and Relevance



**Structural materials in nature
100 % fibre-based**

Our materials: up to 10 % fibre-based



High potential to use more fibres

Carbon, glass, polymer, metal, ceramic...

**~ 100 mio. t/a Fibres consumption
world-wide**

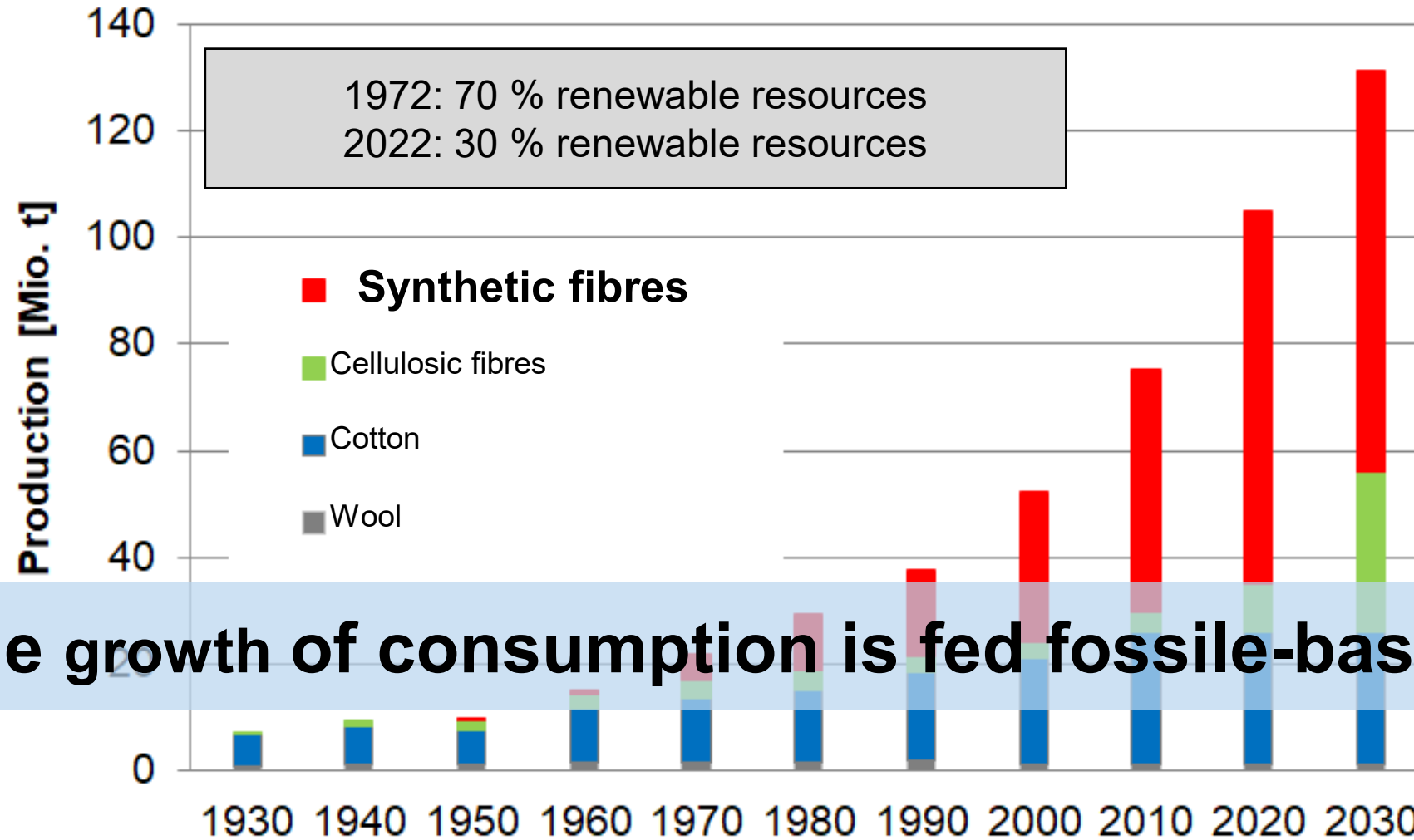
#2 Consumer sector in Germany

#3 Economical sector world-wide

The background is a vibrant green with a fine, woven texture. Overlaid on this texture is a faint, embossed illustration of a person in a dynamic pose, appearing to be climbing or pushing up a steep, hilly slope. The person is positioned in the lower-left quadrant, with their body angled upwards towards the right. The overall composition suggests a theme of effort, challenge, and progress.

BioEconomy- an up-hill battle?

Sustainability and defossilisation are targets of highest urgency



The growth of consumption is fed by fossil-based fibres



Wardrobe Study: on average only 3 - 4 use cycles

Where are we today in general?

Prof. Dr. Achim Kampker

ZUKUNFTSLUST

2. Aufl., Bene!, München 2024

+ Overview on all relevant technology fields

+ Overview over all industry sectors



Textile Recycling Quota: app. 1 % only

-- Recycling quota overall 2023 only 5 %

(2018 6 % !)





BioEconomy- the Solution

Accelerating the transformation to sustainability in the textile industry

Endemic



<1800

Colonial



1800

Wood



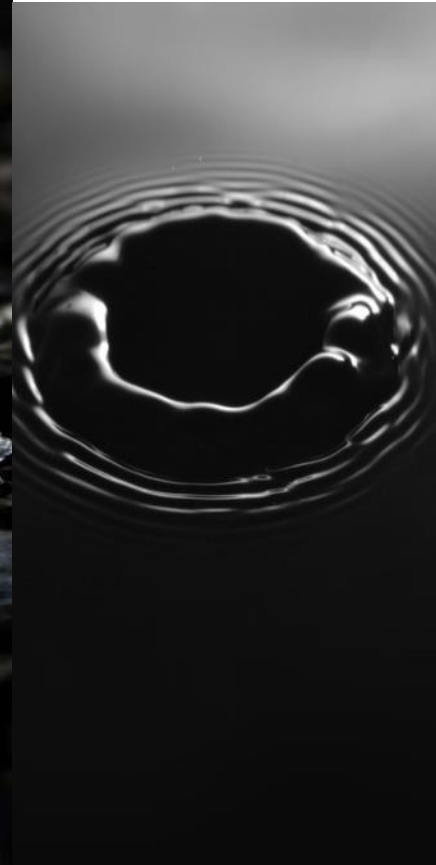
1897

Coal



1935

Petro



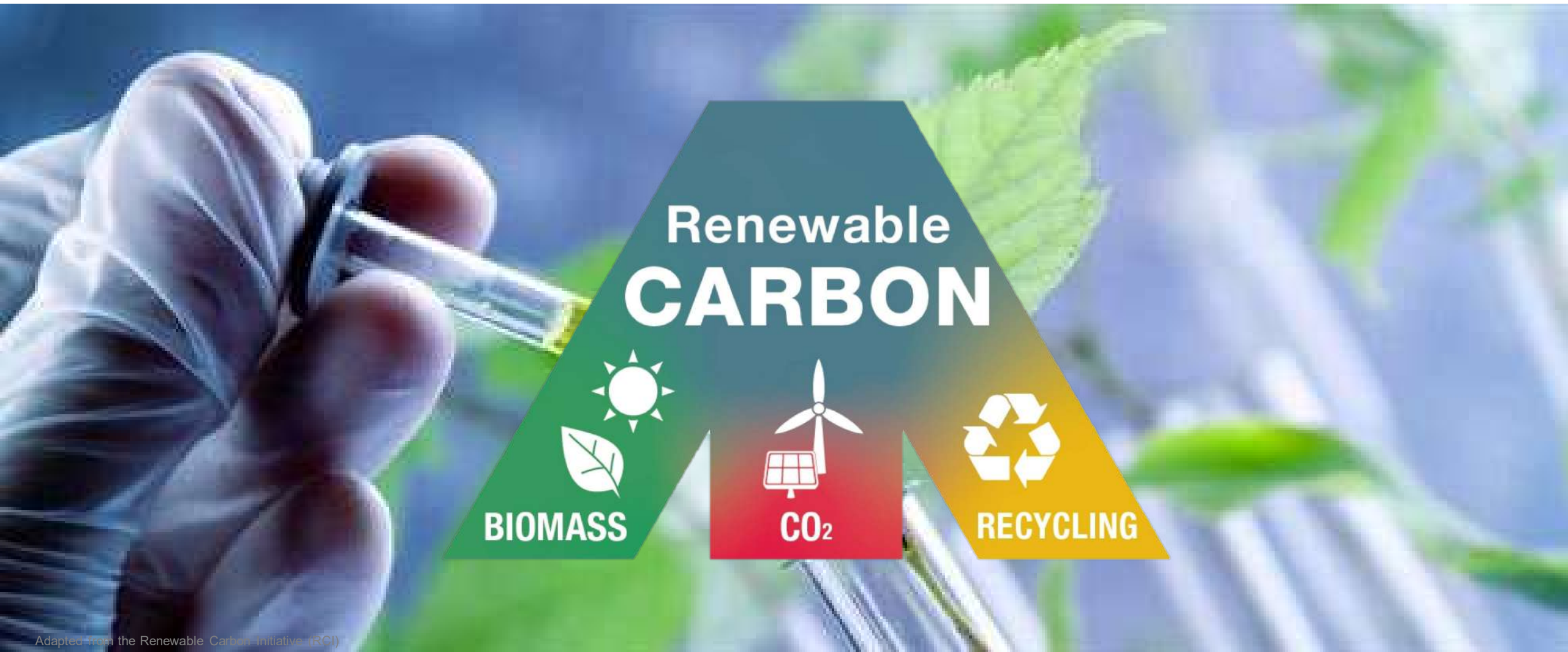
1950

Bioeconomy



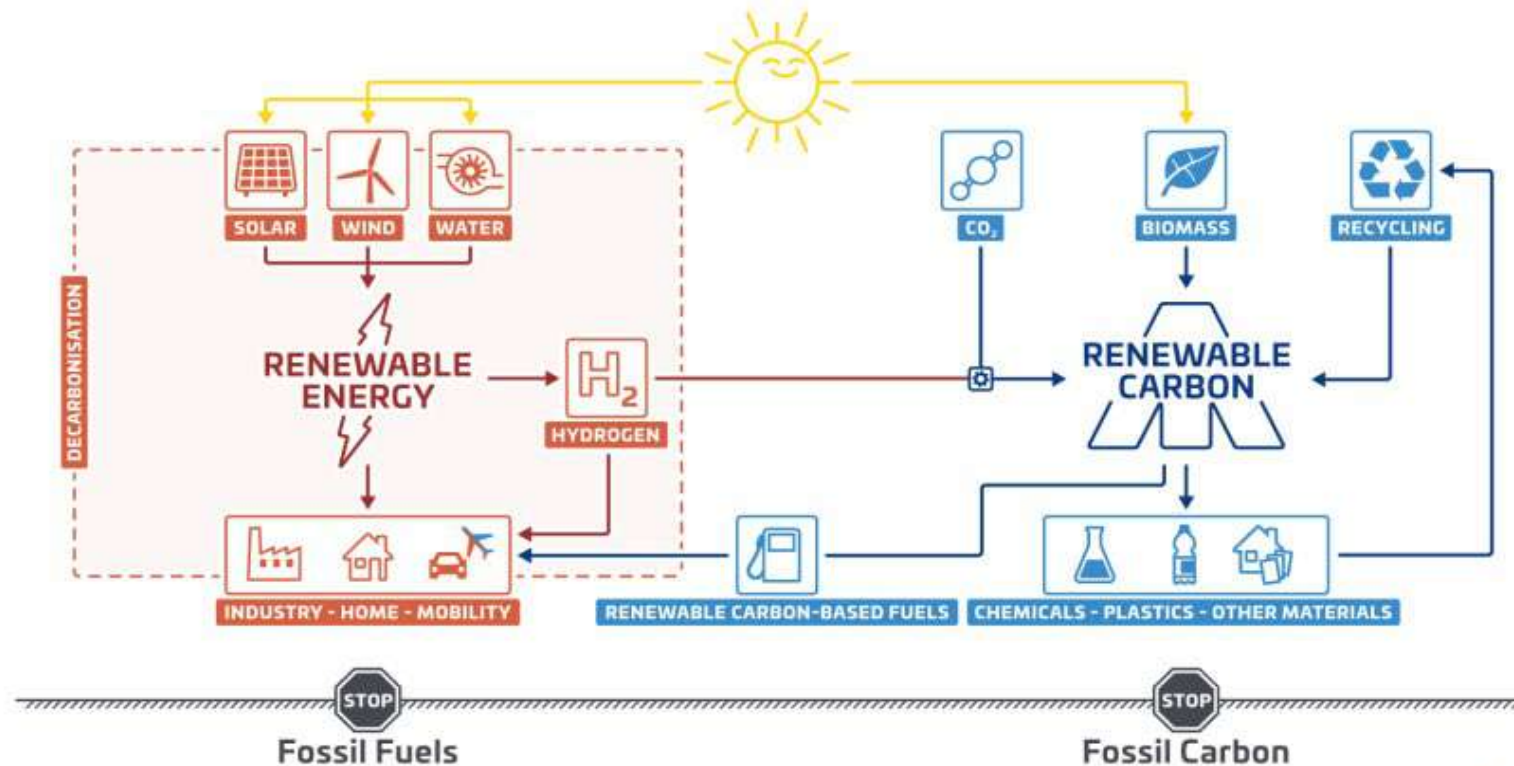
>2020?

Renewable Carbon Strategy - 3 pathways towards defossilisation



Adapted from the Renewable Carbon Initiative (RCI)

Renewable Energy and Renewable Carbon for a Sustainable Future



All figures available at www.bio-based.eu/graphics

© nova-Institute.eu | 2019



Michael Carus

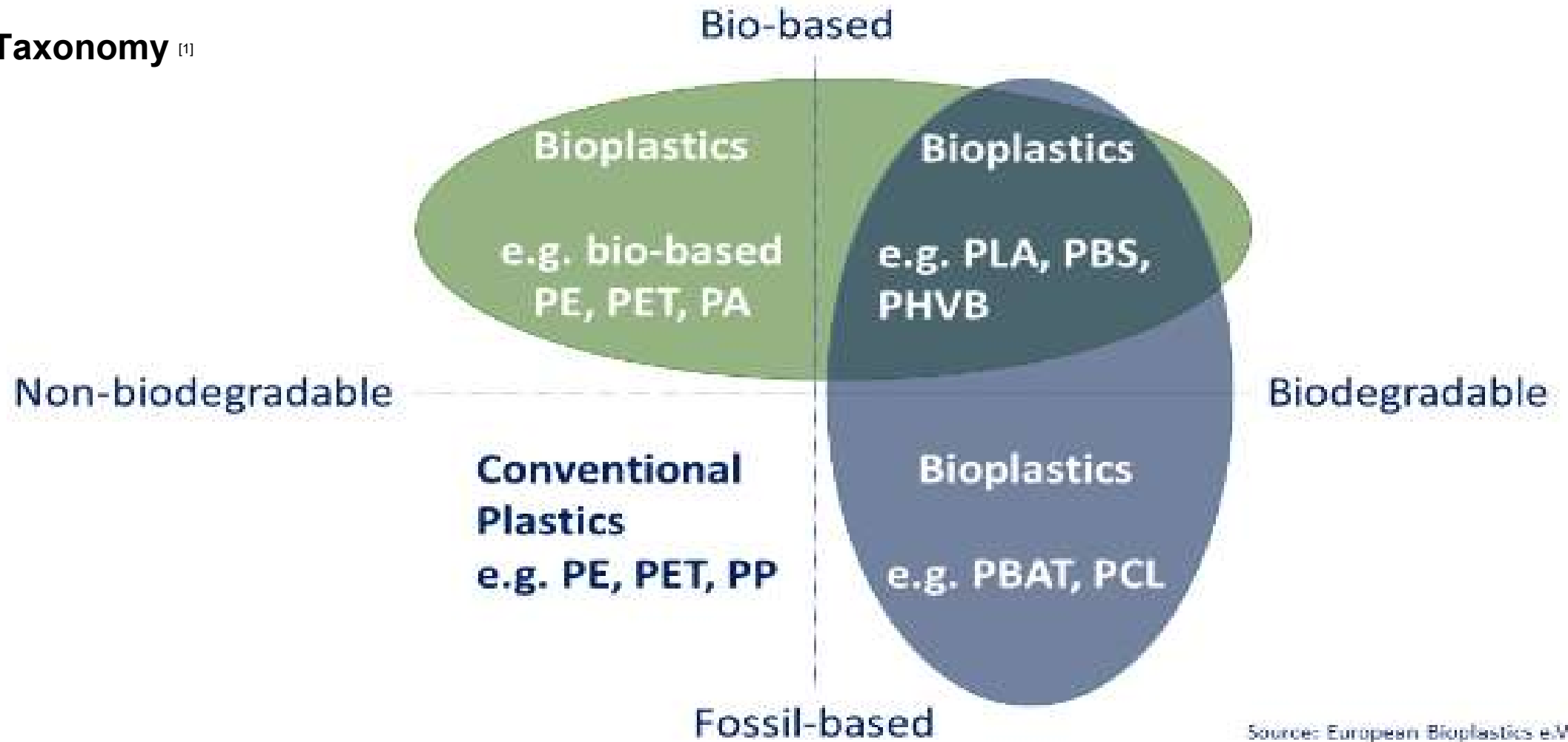


BioEconomy- the Solution

1. Bio(based)polymers

Bio-based and Biodegradable Matrices

Polymer Taxonomy ^[1]



Source: European Bioplastics e.V.



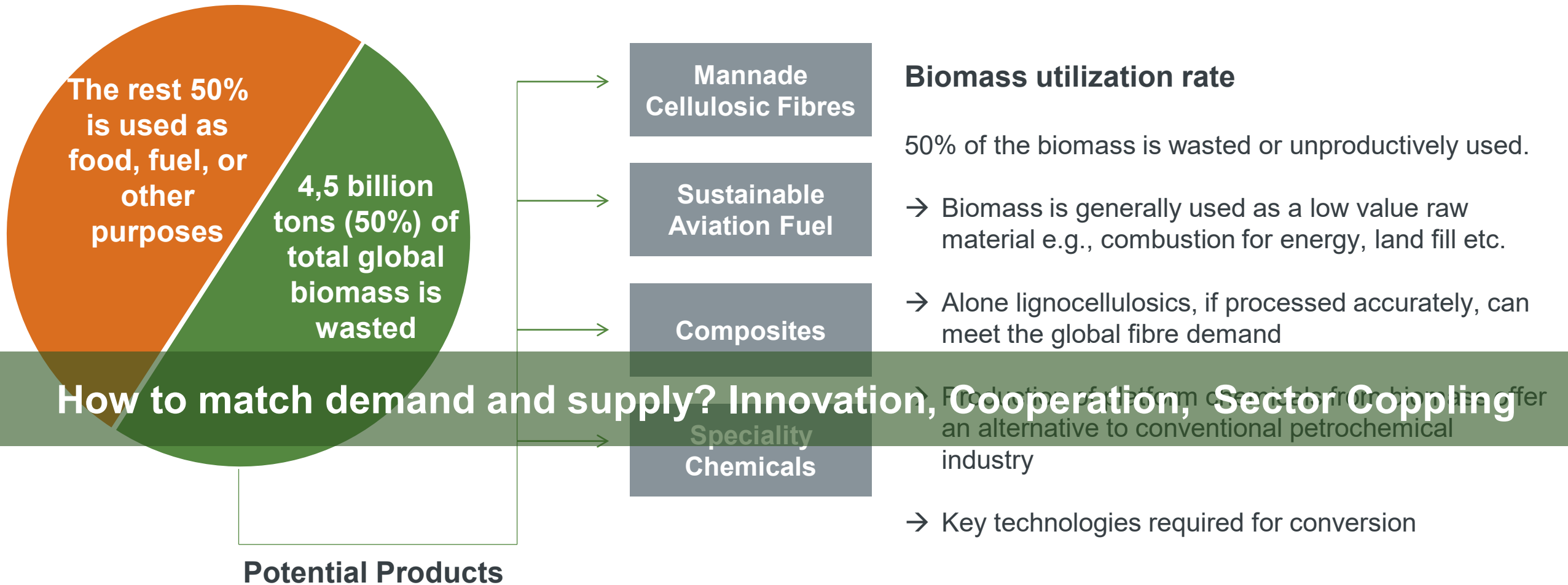
CELLULOSE FIBRES CONFERENCE — 2025

12-13 March
Cologne (Germany)

The renaissance of Cellulose Fibres?



Bioeconomy has the potential for structural change



Ecolocked. (2023, March 15). Waste Biomass: An Untapped Resource for Carbon Removal.
Ecolocked. <https://www.ecolocked.com/de-de/blog-posts/waste-biomass>

Textile Exchange. (2024, September 26). Materials Market Report 2024.
Textile Exchange. <https://textileexchange.org/knowledge-center/reports/materials-market-report-2024/>

**Circular Economy
(CE)**

**"...is a system in
which materials never
become waste and
nature is regenerated'**

-Ellen MacArthur Foundation

**biobasierte
Circular Economy**

Bioeconomy

**Replacing fossil
resources with
renewable bio-based
materials**

An aerial photograph of a lush green agricultural field, possibly a rice paddy, with a winding path or canal cutting through it. The text is overlaid on the right side of the image.

BioEconomy- the Solution

2. Carbon-Capture-Usage

Carbon Capture Usage

- Separating CO₂
- Chemical processes (e.g. CO2Tex)
- Biotechnological Processes (e.g. AlgaeTex)



BioTexFuture – CO2Tex



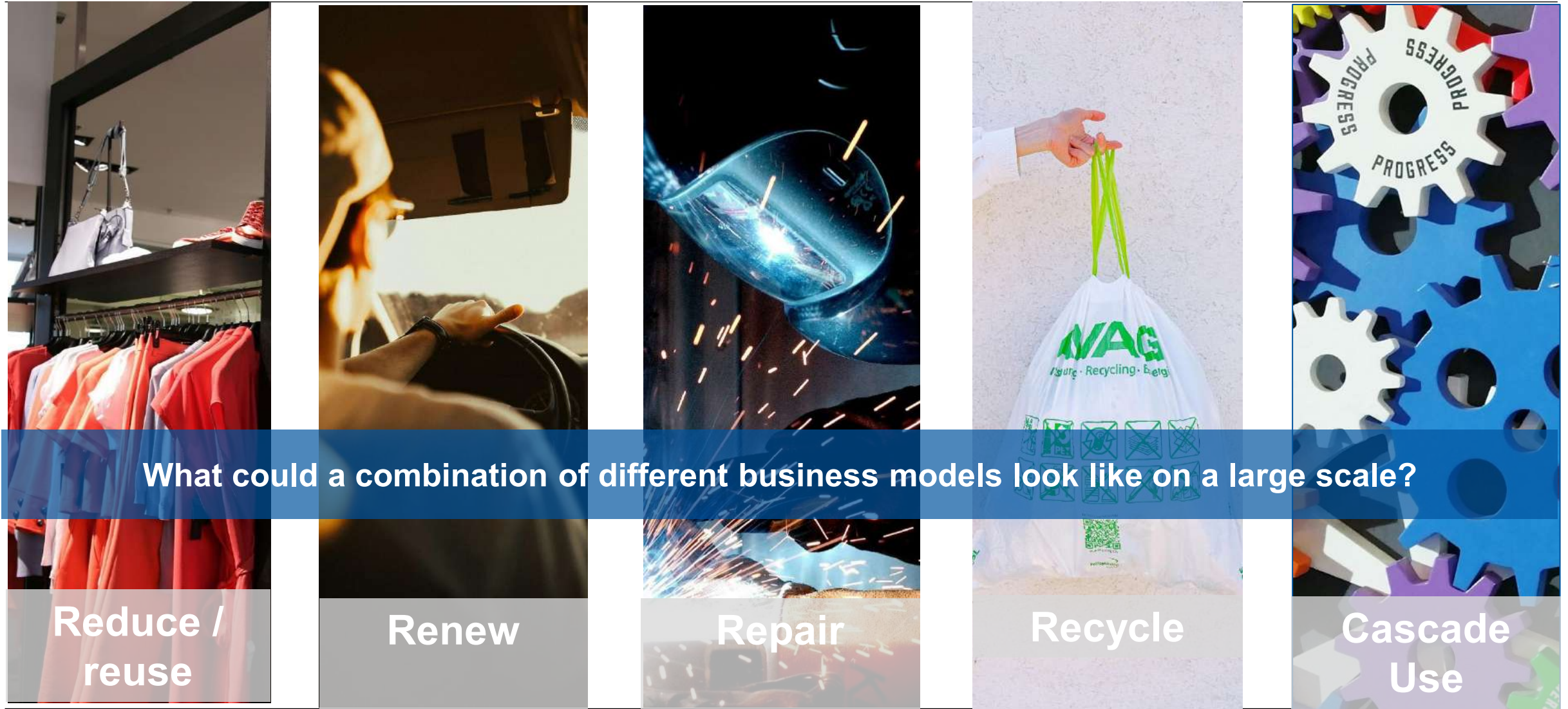
BioTexFuture - AlgaeTEx



BioEconomy- the Solution

3. Recycling

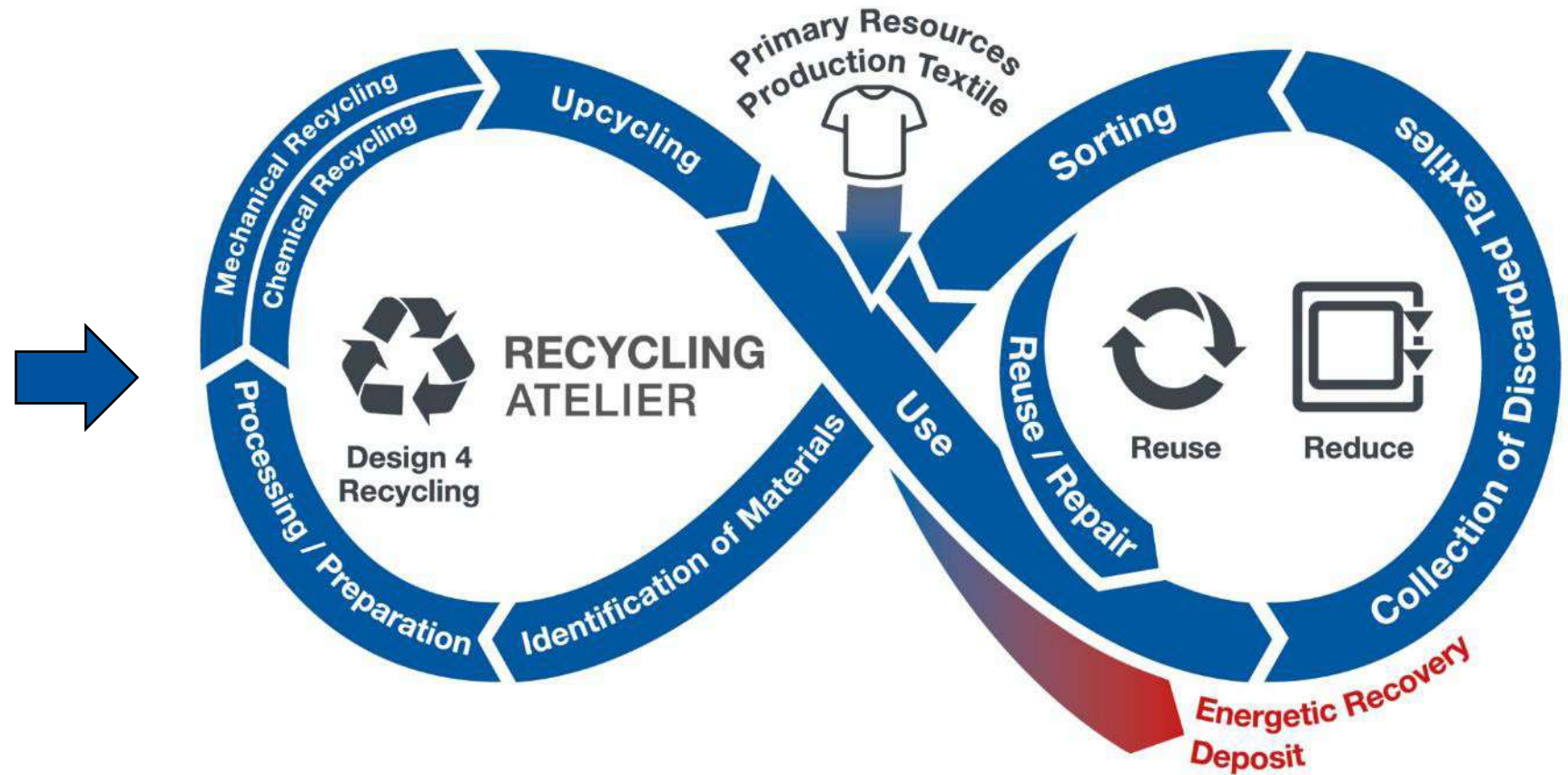
Different Models of Circular Economy



Vision of modern polymer cycle: high-quality recycling instead of landfill and energy recovery



CEID-Roadmap, 2021



Solution only by Cooperation and Open Innovation

Recycling Atelier at ITA Augsburg



2. Sorting

3. Cutting and Tearing

4. Textile Processing

7. Workshop Area

Recycling Atelier at ITA Augsburg
25 Partners from Industry and Research jointly develop
Solutions through Cooperation on this Open-Innovation-Platform

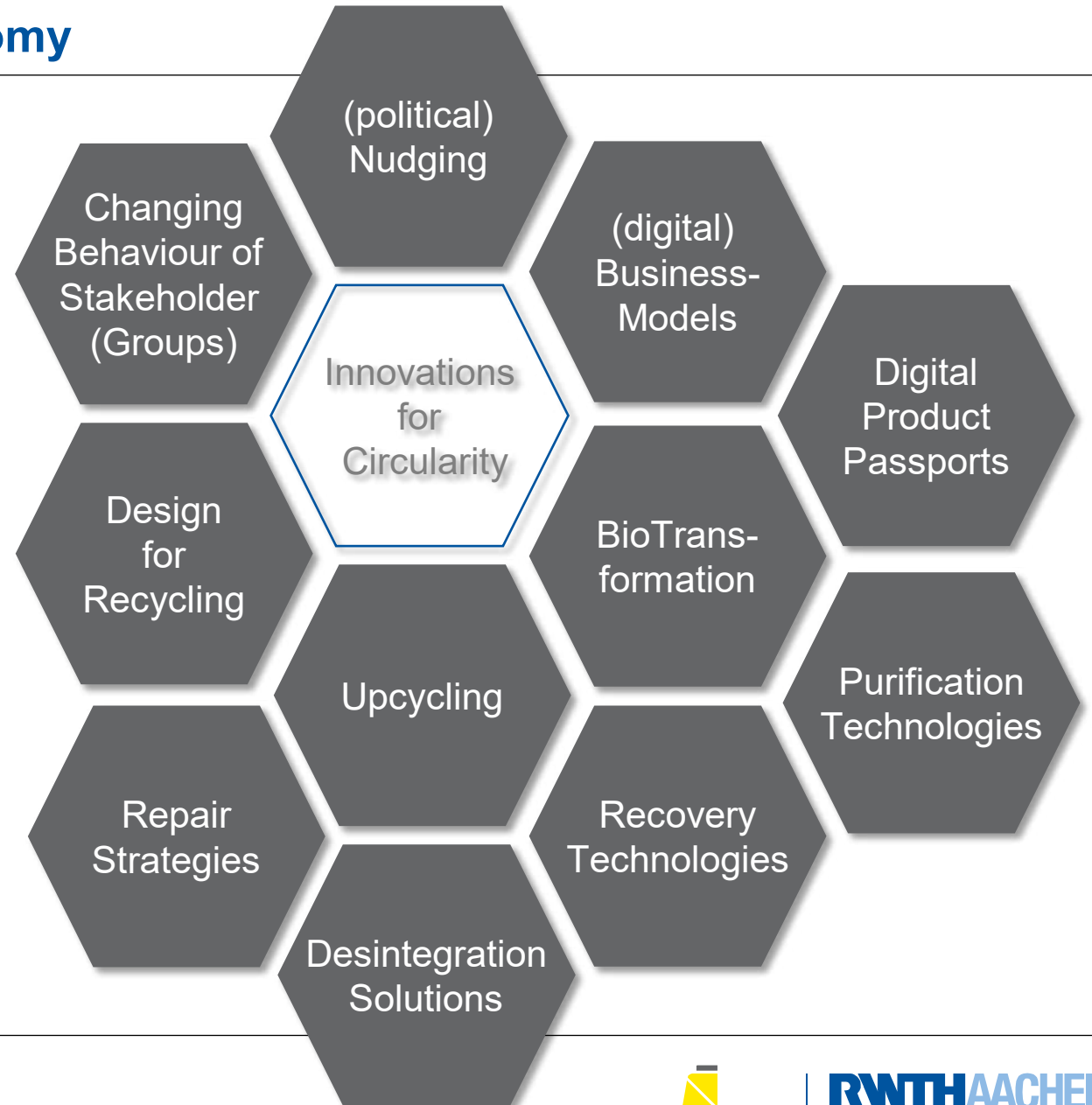
1. Material analytics

6. Product Design

5. Spinning

Fields of Innovation for a new Circular Economy

- Fewer, longer-lasting and more durable products
- Avoid overproduction
- Reuse and repair above recycling
- Textile recycling is an approach to becoming more sustainable
- Design for recycling
- Sustainable distribution of waste and recycled materials



100 % Recycling?



100 % Recycling Content?

Yes – ever!

100 % Recycling?



100 % Recycling Content?

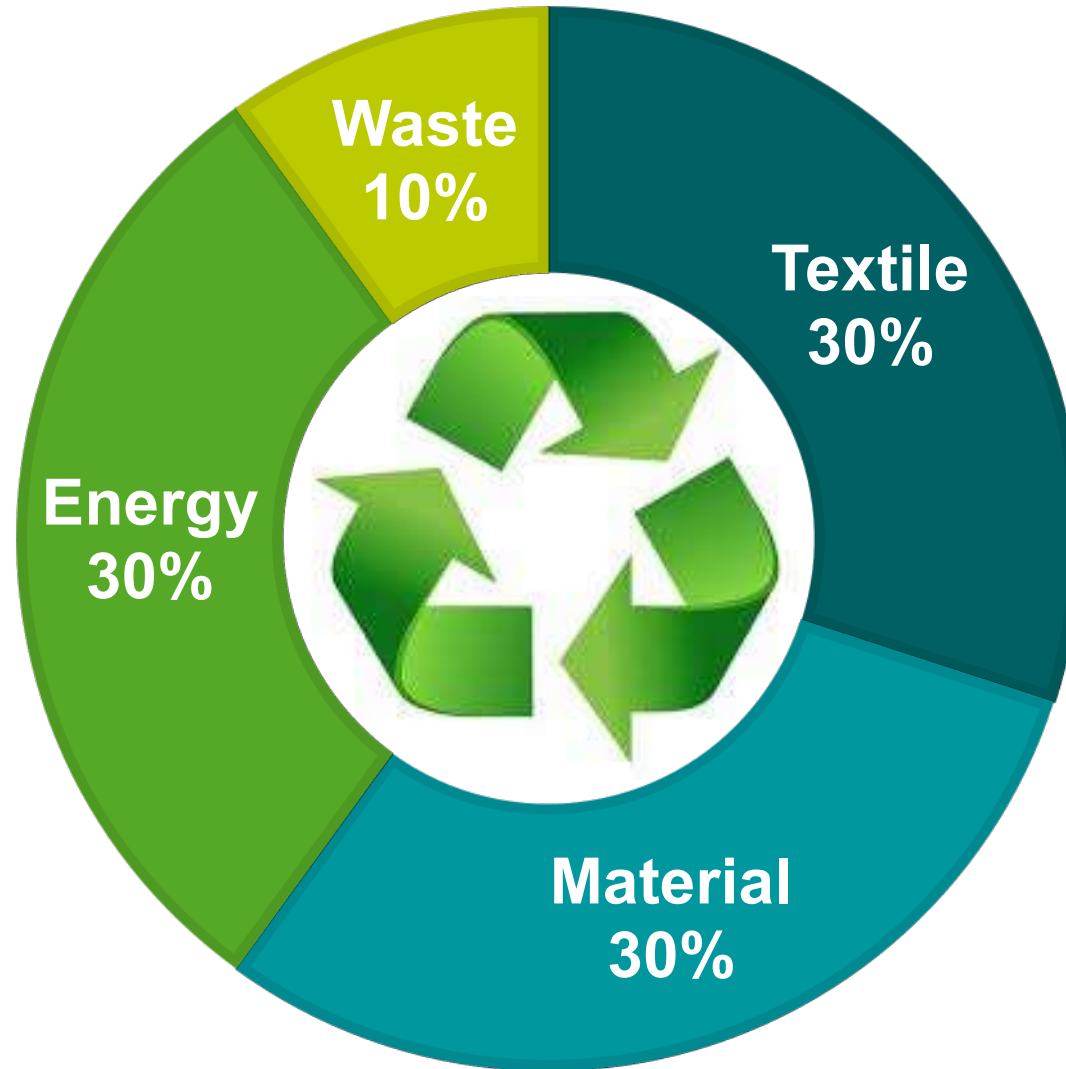
Yes – ever!

100 % Fiber to Fiber?

No – never!

100 % Textile-to-Textile Recycling is an Illusion

***Bold thesis on
recycling shares***



***Based on the 2.
Fundamental Law
of Recycling
[Th.Gries]***

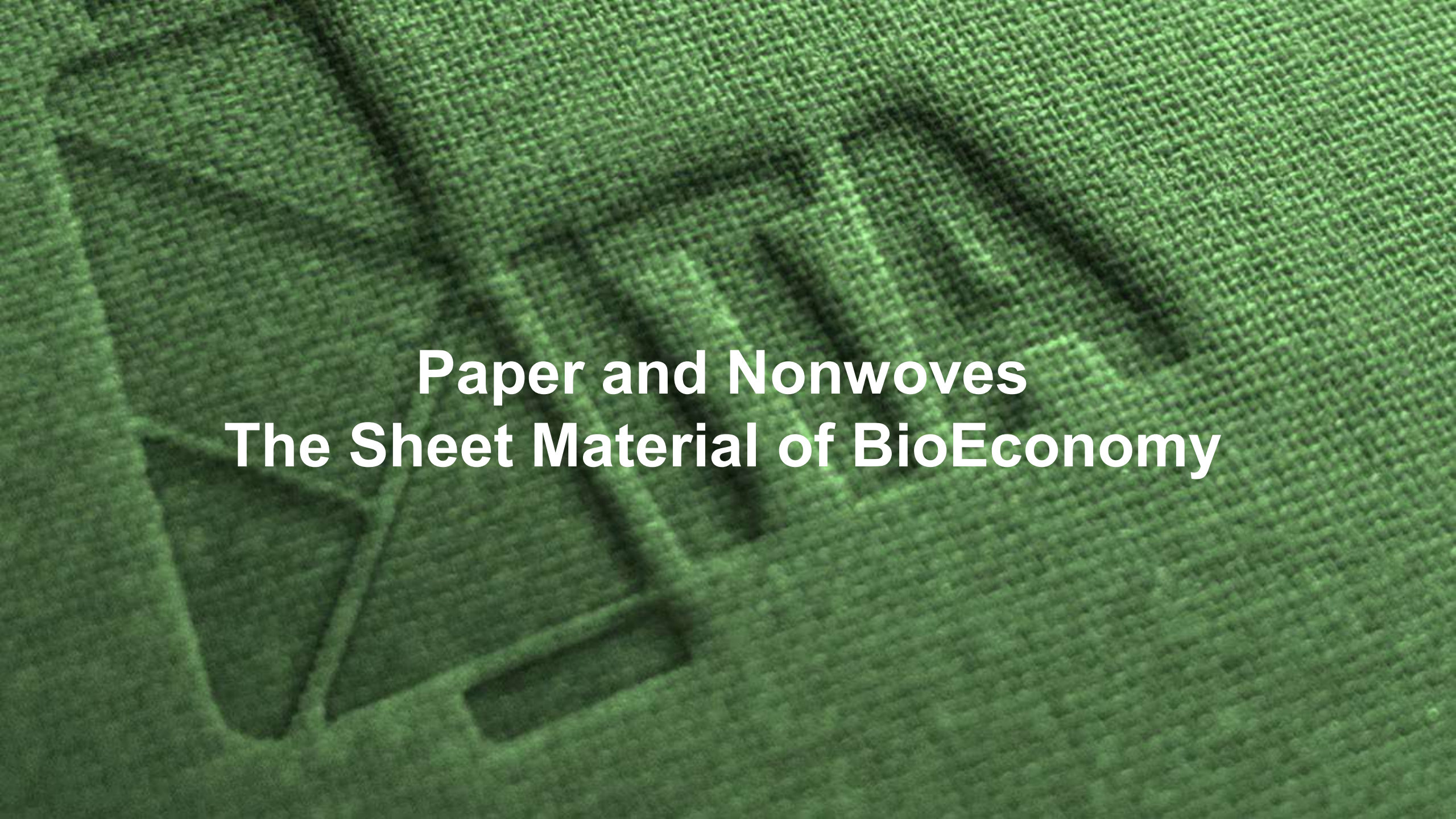
Sector coupling



Example: Bio-based circular economy

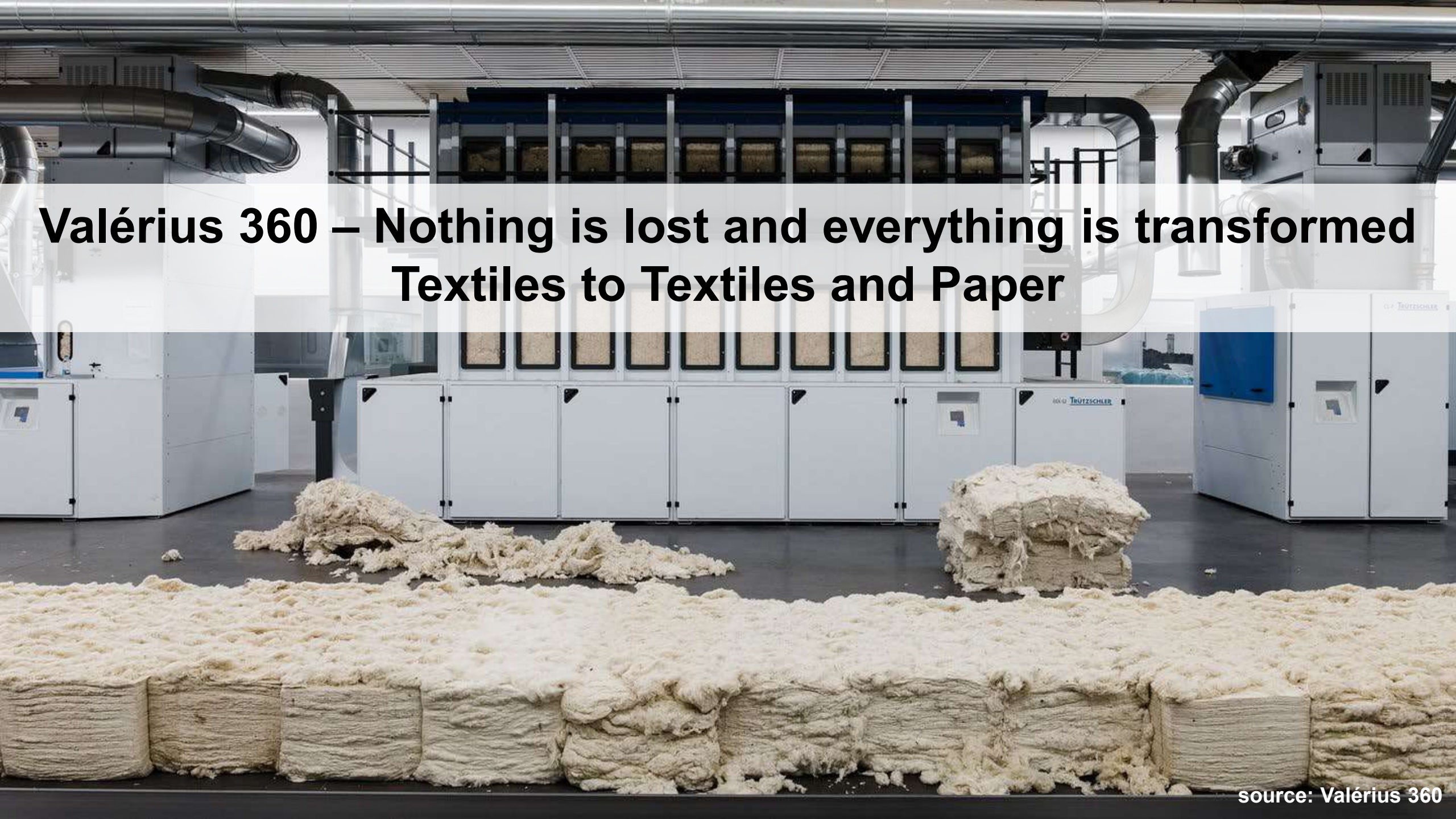
- Network of (supra-)regional stakeholders from business, science and society
- Disclose, use and expand potentials and synergies
- Establishing circular value creation innovatively and economically
- Structural change for the economy, society and nature in the Rhine region





Paper and Nonwoves

The Sheet Material of BioEconomy

The image shows a large industrial facility, likely a textile or paper mill. In the background, a long row of white machines with multiple processing units is visible. The floor is dark and covered with large, irregular piles of raw, light-colored textile material, possibly wool or cotton. The overall scene is industrial and clean.

Valérius 360 – Nothing is lost and everything is transformed Textiles to Textiles and Paper

Modellfabrik Papier – Triple-Helix-Innovation for 80 % Less Energy Consumption in Papermaking



Source: Modellfabrik Papier gGmbH

Modellfabrik Papier – Triple-Helix-Innovation for 80 % Less Energy Consumption in Papermaking





Digital Nonwoven Innovation Center – digital ■ natural ■ clean ■

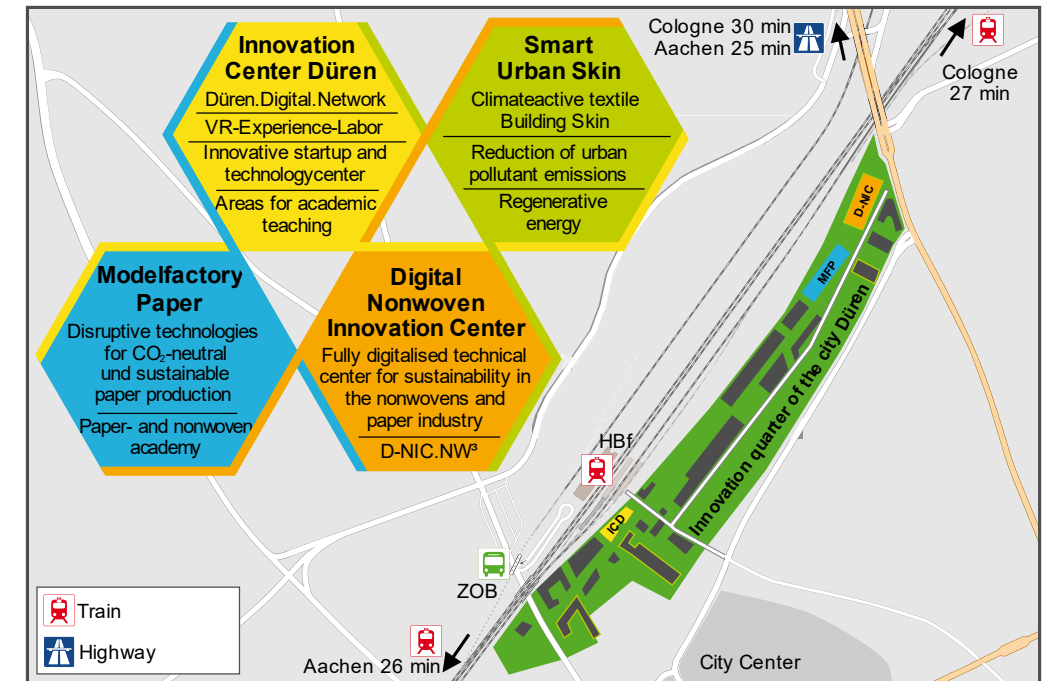
D-NIC – Digitalisation and Sustainability in the Nonwoven Industry

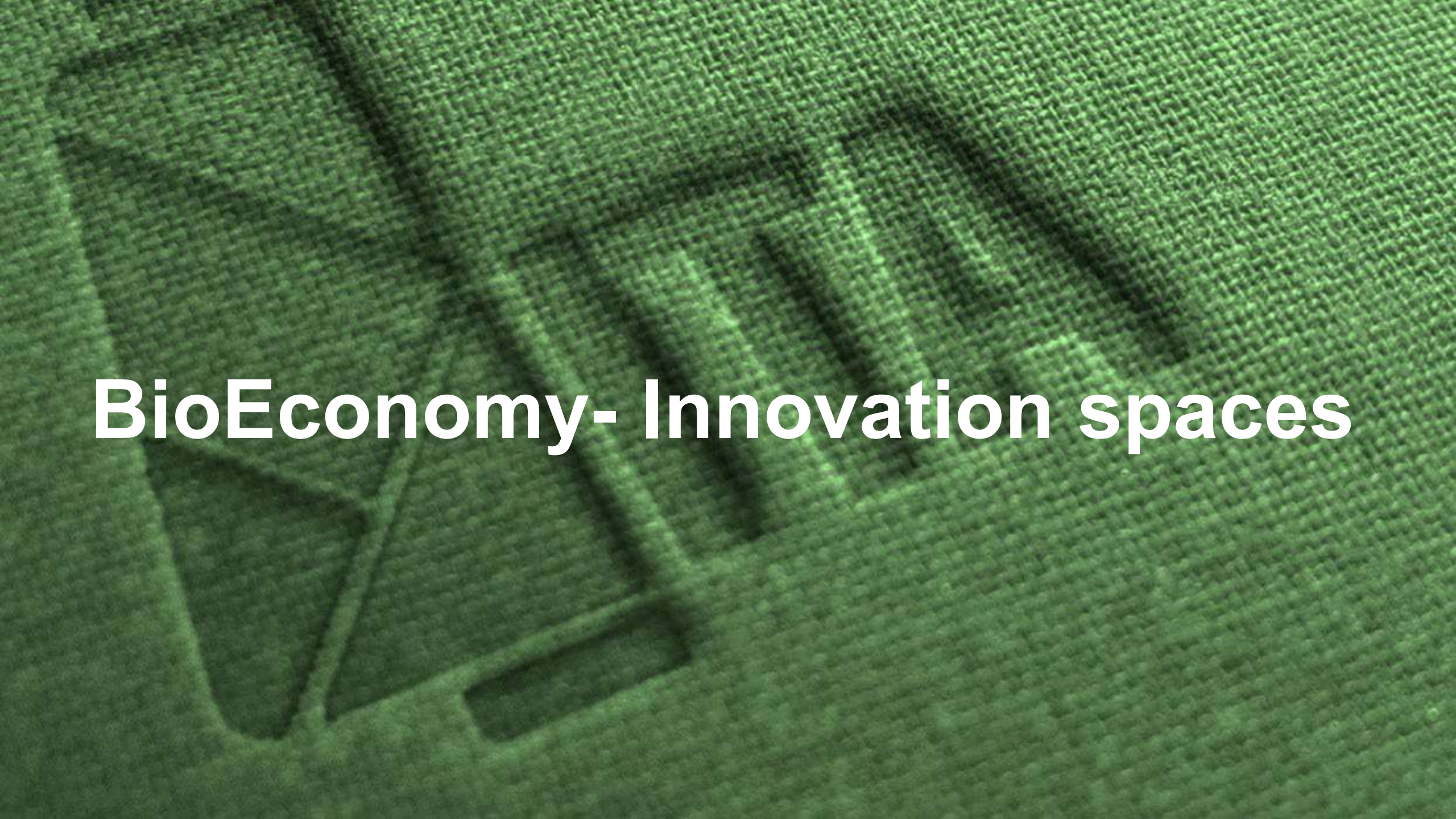
The D-NIC is a beacon of the digitalized and sustainable fibre industry in the heart of Europe!

Innovation and qualification through synergy with industry and research institutes in surrounding area

- I. Development of innovative processes**
- II. Processing of new raw material sources**
- III. Product development makerspace (analog+digital)**
- IV. Digitally supported process and product development**
- V. Collaborative training**
- VI. Innovation quarter as a transfer space**

Nonwovens and paper are platform technologies for bioeconomy and complement each other synergistically





BioEconomy- Innovation spaces

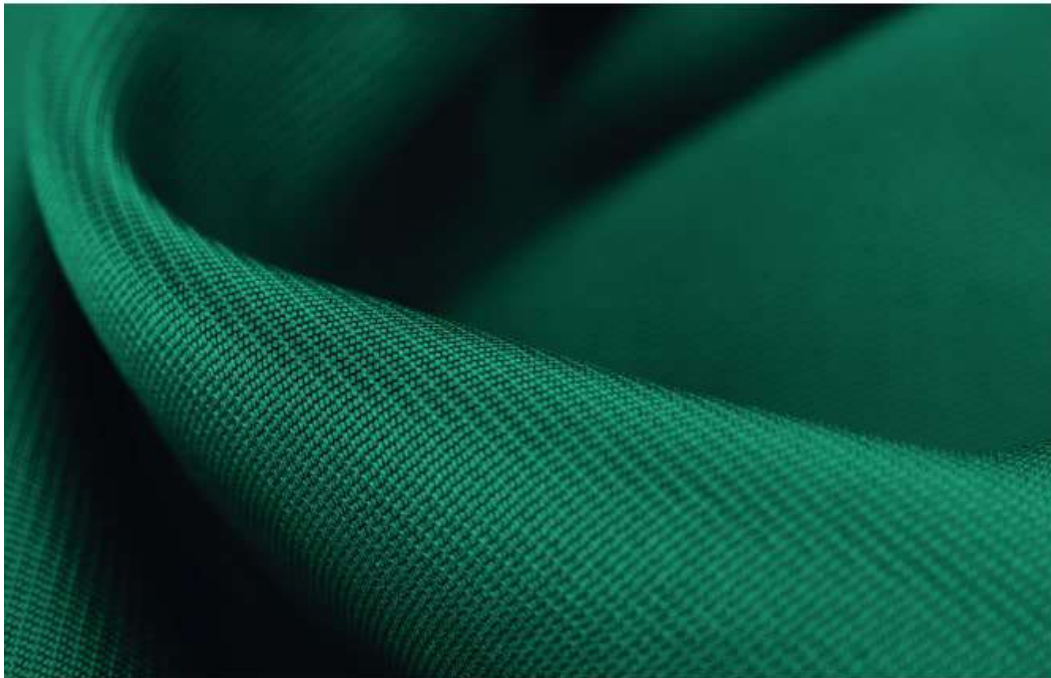
INNOVATION SPACES



FOUR INNOVATION SPACES TO TRANSFORM OUR ECONOMY

With the funding concept "[bioeconomy innovation spaces](#)", the German [Federal Ministry of Education and Research](#) (Bundesministerium für Bildung und Forschung, BMBF) supports the development of bioeconomic innovations as drivers for a sustainable, biobased economy.

The aim is to use research results more comprehensively than ever before and to initiate processes that become building blocks of change in society as a whole to the benefit of the bioeconomy. The scientific prerequisites for this are excellent in Germany. There is great potential for new ideas. By uniting several projects within the innovation spaces the BMBF is creating platforms for science, industry and society to collaborate under a shared vision and use these ideas for cross-sector innovations.



CREATE THE CHANGE

ABOUT US

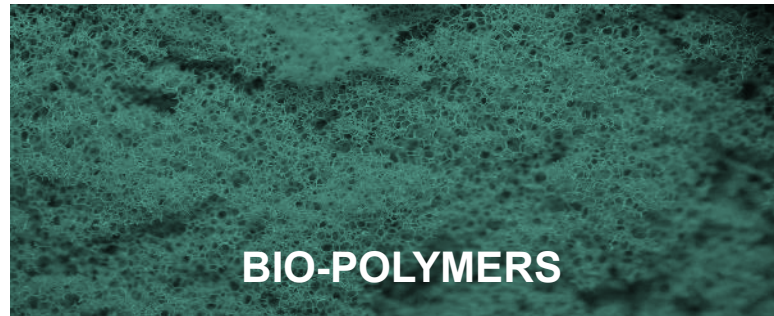
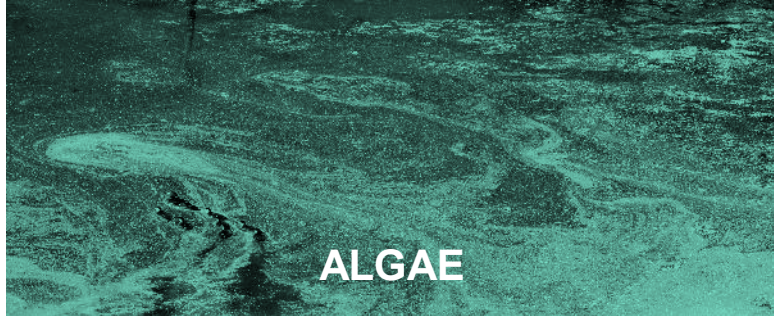
BIOTEXFUTURE is an innovation space funded by the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF) on **bio-based textile research**. Since November 2019, adidas is co-leading the program in collaboration with the RWTH Aachen University.

We are collaborating with industrial and scientific partners who share our vision to convert the textile value chain from petroleum-based to bio-based and strive every day to create the change.

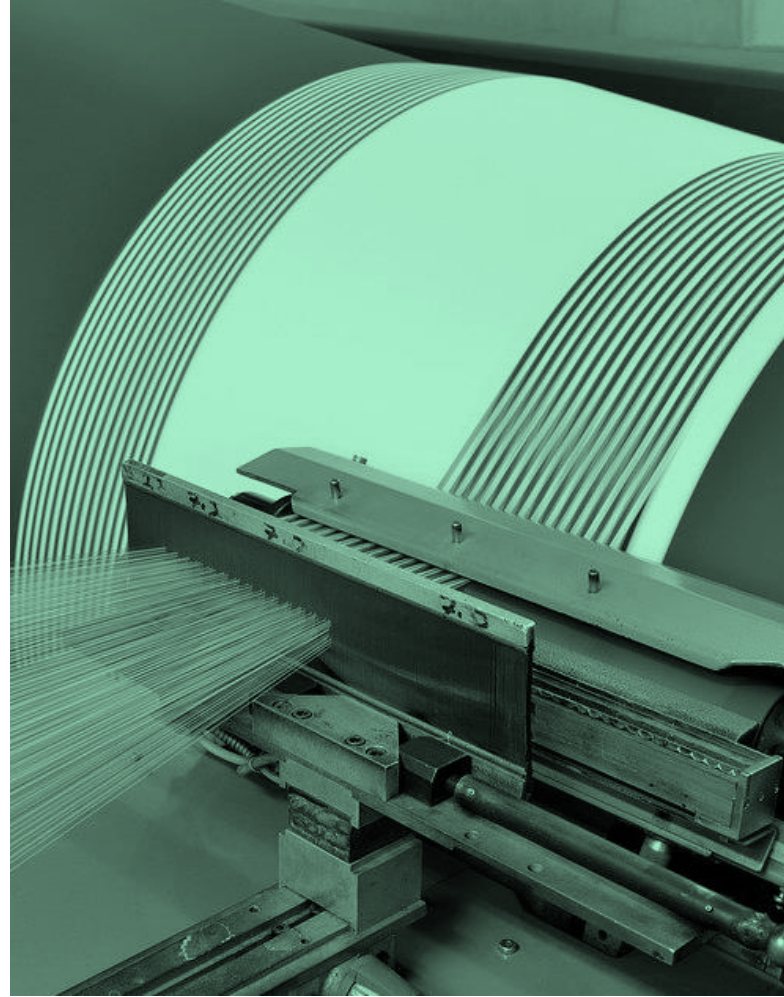
SCOPE OF BIOTEXFUTURE

THE INNOVATION SPACE IS ADDRESSING THE COMPLETE TEXTILE VALUE CHAIN

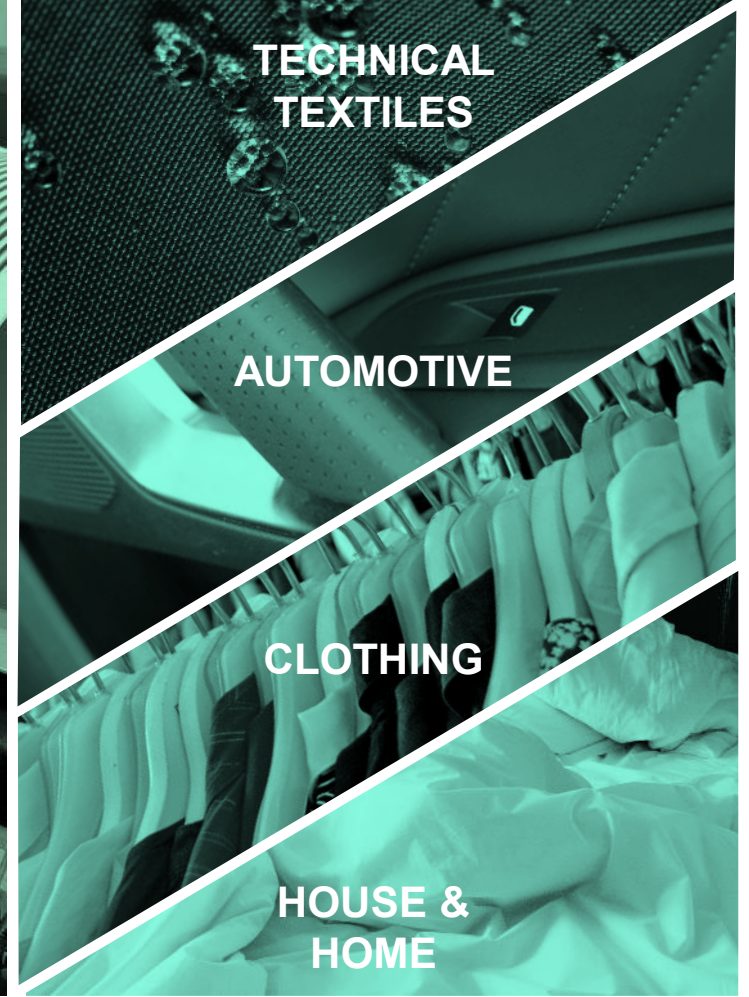
BIOTEXFUTURE



Sustainable Resources



Innovative Processes



Novel Applications



#Building The Future

be@t - Bioeconomy at Textiles

PROMOTING ENTITY:

TECHNOLOGICAL CENTRE FOR TEXTILE AND CLOTHING OF PORTUGAL – CITEVE

PROJECT'S STRUCTURE:

4 Pillars:



biomaterials

Cellulose, Lignin & Forest Pulp

- Fibers
- Non-Woven Fabric (TNT)
- Matrices for bio-based composites

Agricultural fibrous biomass

- Alternative natural fibers (mechanically and biochemically processed)
 - Banana leaves from Madeira
 - Pineapple from the Azores
 - Hemp from the Center
 - Flax from North
 - Alentejo Rice Straw



circularity

Circular (bio) processes

- Recycling (biochemical and mechanical)

Industrial symbiosis

- Recovery of waste from other industries
 - Collagen
 - Hydroxyapatite
 - Chitosan
 - plant extracts
 - Cork
 - Leather
 - wood



sustainability

Eco design and Eco Engineering in closed loop (zero waste)

Validation and Metrics

- Percentage of Bio, Recycled & Recyclable
- Business and Green Equity
- Carbon Footprint

Digital Tracking

- Transparent and trustworthy Supply Chain



society

Responsible Consumption

- Consumer information and promotion of good consumption behaviour
 - Conscious purchasing
 - Reuse/repair

Raising awareness of labelling

- Uniform, simple, objective and clear textile product ID

Involvement of Value Chain

- Stakeholders & Brands

International markets

- Promotion of the brand "Responsible Textiles from Portugal" (iTechStyle Green Circle®)



BioEconomy- Disposables



Any Renewable Carbon Solution available?



AES

From waste to oil!

Marco Karber



karber@aestechnik.de



+49 (0)176 84948303

Transforming waste to a crude oil like product with the AES technology

Output: pyrolysis oil with „crude oil“-quality, which can be sold to refineries

INPUT



PROZESS



OUTPUT



The background is a vibrant green with a fine, woven texture, resembling a high-quality fabric or technical textile. Overlaid on this texture is a faint, large-scale geometric pattern consisting of several overlapping triangles and quadrilaterals in a slightly darker shade of green, creating a subtle architectural or crystalline feel.

BioEconomy - Technical and Home Textiles

(utmost sector-specific)

BioTexFuture - BioTurf



BioEconomy - Composites

Carbon fibre applications



Wind energy

Aerospace

Sports & Leisure

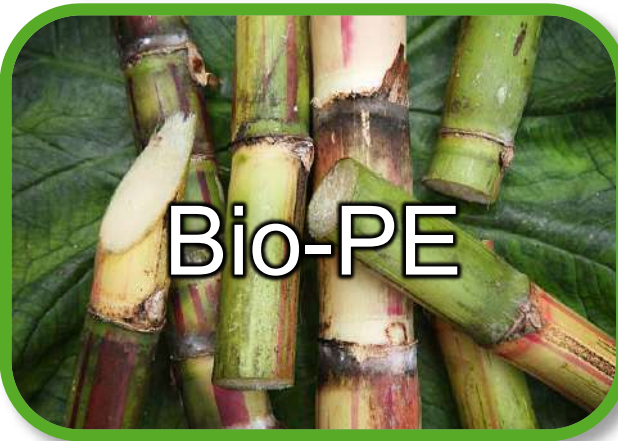
Automotive

Pressure Vessels

Construction

Other Industries

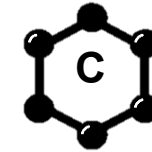
Sustainable raw material sources for carbon fibre production



Raw material availability



Raw material costs



Carbon-yield



Mechanical properties



Time to Market

**Bio-based PAN is the „fast drop-in“ solution.
Bio-based PE combines sustainability and cost-efficiency for bio-based CF and CFK.**

Natural Fiber Composites

Sports – Surf Board

Conventional Materials

Epoxy/Polyester GFRP

ITAs interpretation with

- Low twist Flax NCF (+/- 45) manufactured at ITA
- Bio-based epoxy resin
- Vacuum infusion



Music – Saxophone Reed

Conventional Materials

Donax Wood

ITAs interpretation with

- Hybrid Yarn Flax PP/PA 11
- Thermoplastic Pultrusion



Recycled & Upcycled Materials in Interiors

Furniture

Conventional Materials: GFRP

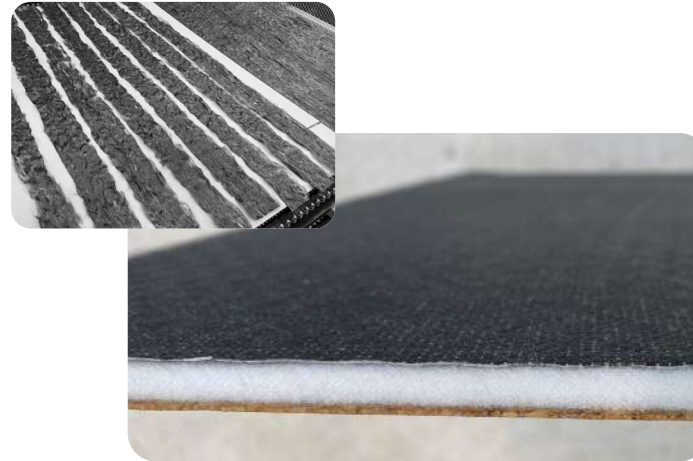


ITAs interpretation with

- Recycled PET foam
- Flax NCF / Upcycling scrap wood
- Design for sustainability & manufacturability

Floorings

Conventional Materials: CFRP



ITAs interpretation with

- Recycled foam
- Recycled CF NCF manufactured at ITA
- Cork

Natural Fiber Composites (NFCs) – Key Applications & Material Forms

Mobility



Sports & Leisure



Reinforcement Forms

Nonwovens, Wovens, Non-Crimp, Tapes, Knits/Grids

Matrices

- Standard & Engineering Thermoplastics
PP, PA, PE, TPU – fossil/bio-based
- Thermosets
Epoxy, PU – fossil/bio-based

Design & Infrastructure



Music, Sound & Noise



Current Application Focus

Replace GF with **no modifications** in the resin and manufacturing process

CO₂ footprint reduction but...

- Limited Biodegradation at EOL
- Difficult to Recycle

The background of the slide features a photograph of numerous gold coins. Some coins are stacked into tall, vertical columns of varying heights, while others are scattered in a disorganized pile in the foreground. The lighting is bright, highlighting the metallic sheen of the coins.

BioEconomy – The economical Challenge

„Everything becomes more expensive“ [Th. Gries]



BioEconomy – The economical Challenge

„Everything becomes more expensive“ [Th. Gries]

- McKinsey Study postulates sustainable solutions (recycling) with a maximum of 10% higher consumer prices
- Marketing experts know the power of (price) segments

- Raw Materials are more expensive
- On-Shoring and Urban-Production result in higher wages
- Decentralized production at 3-5 times smaller units lead to „negative“ Economics-of-Scale

- 
- New Business Models
 - Digitale Business Models and Producer Networks
 - Direct B2C or C2M Business Models

Value Chain today – there is room for new business models!

Chino



SP 100,- €

Outdoor-Jacket



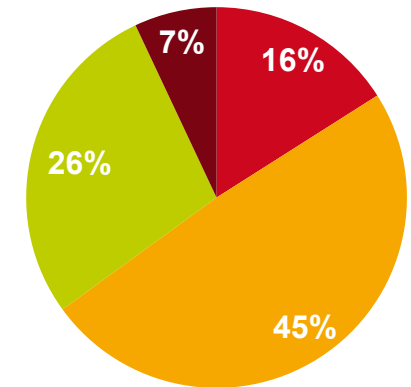
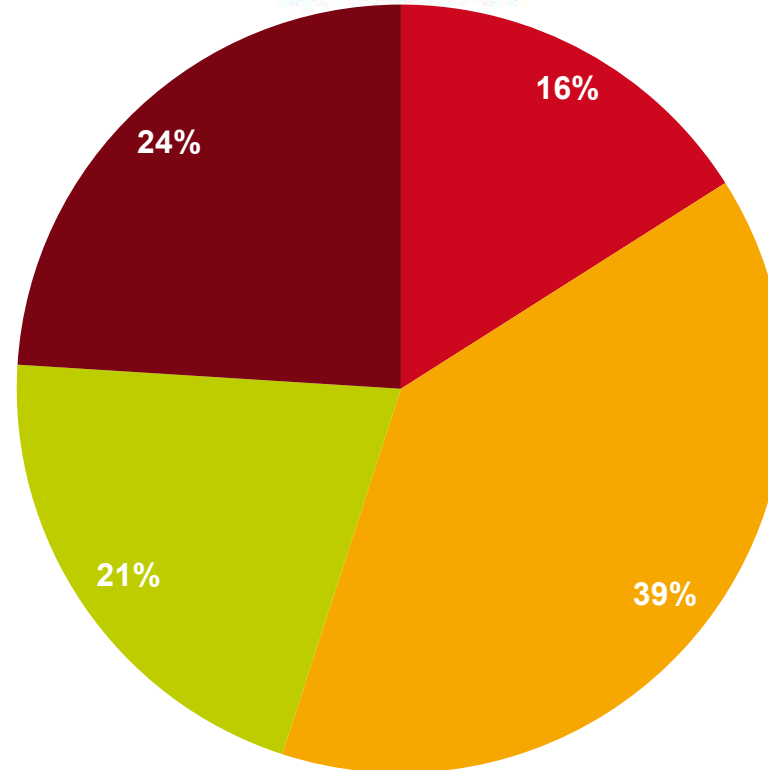
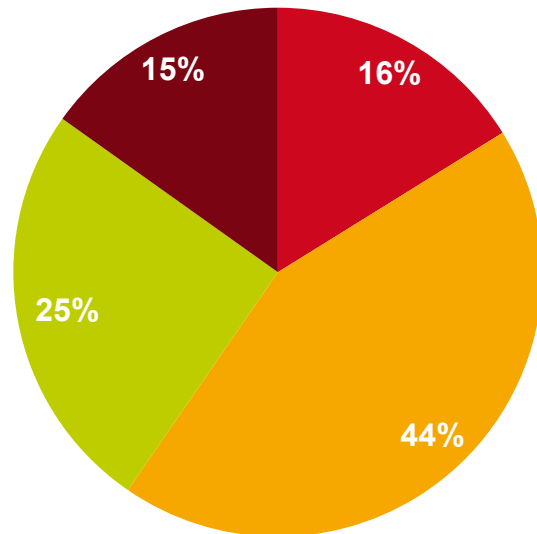
SP 200,- €

Business Shirt



SP 50,- €

■ VAT ■ Retail ■ Brand ■ Production



Source: Vaude, own Studies

**DRILL, BABY,
DRILL**

**Driving BioEconomy
into a bright Future
through Cooperation.**

**Let's join all our Forces
for our mutual Success!**

**GROW, BABY
GROW**

**THE FUTURE OF BIOECONOMY
FOR THE TEXTILE SECTOR**



Thomas Gries – Ahmedabad/India 2025

Contact



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Events: www.ita.rwth-aachen.de/events

Social Media: [!\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#) [!\[\]\(f6b0299e0b5e4340e509b71914970da0_img.jpg\)](#) [!\[\]\(b5153706f6ea2fc2c42e8803b6804d18_img.jpg\)](#) [!\[\]\(2b8adb27d8c9518333278b6317e2d8a2_img.jpg\)](#) [!\[\]\(a190466037967efc7087885259e58e7a_img.jpg\)](#) [!\[\]\(cf3e77ddea19a725a08de3103e34778f_img.jpg\)](#)

Thank you
for your attention!

www.ita.rwth-aachen.de

