Challenges and opportunities of the textile industry based on renewable materials

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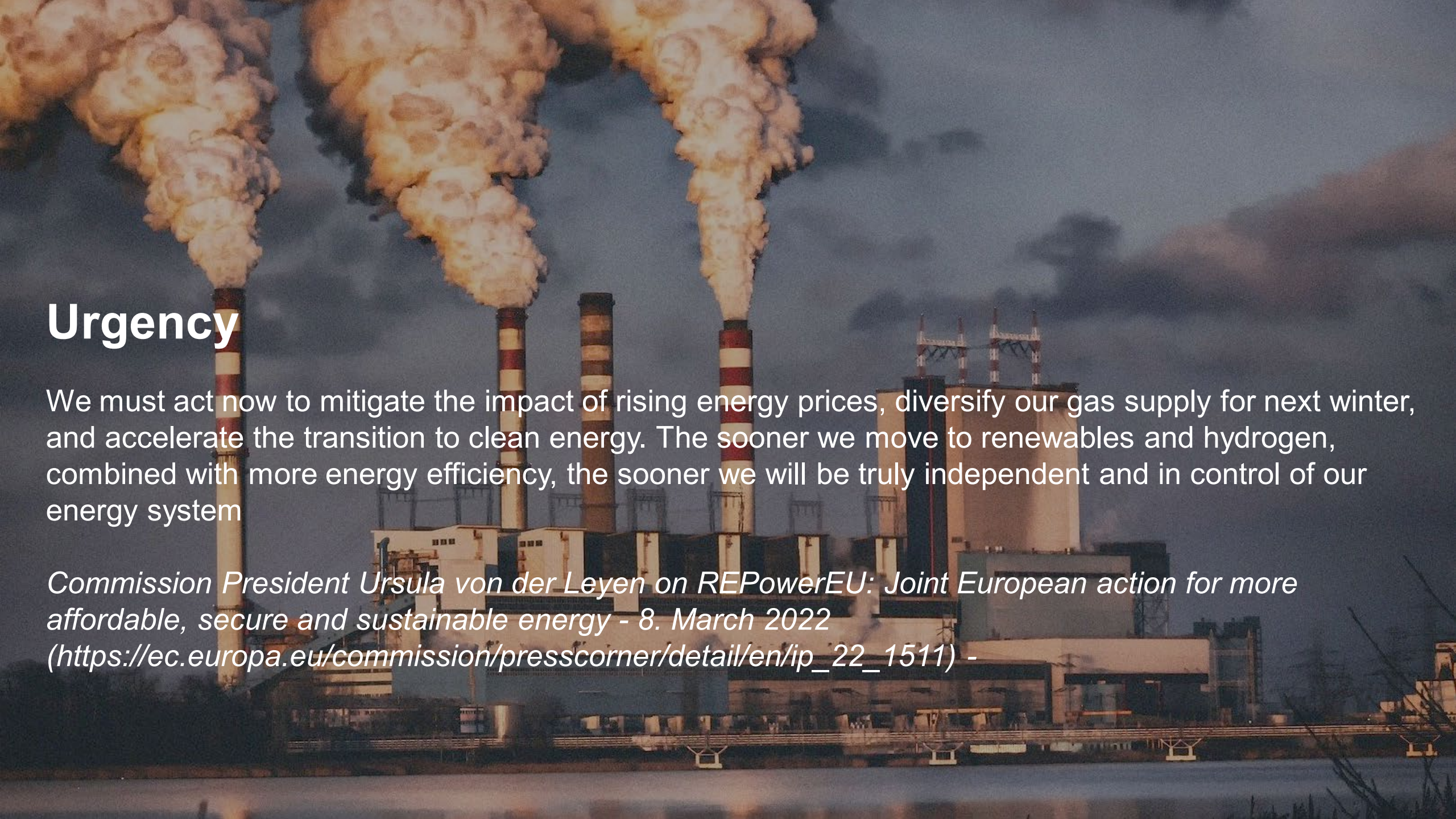


Urgency

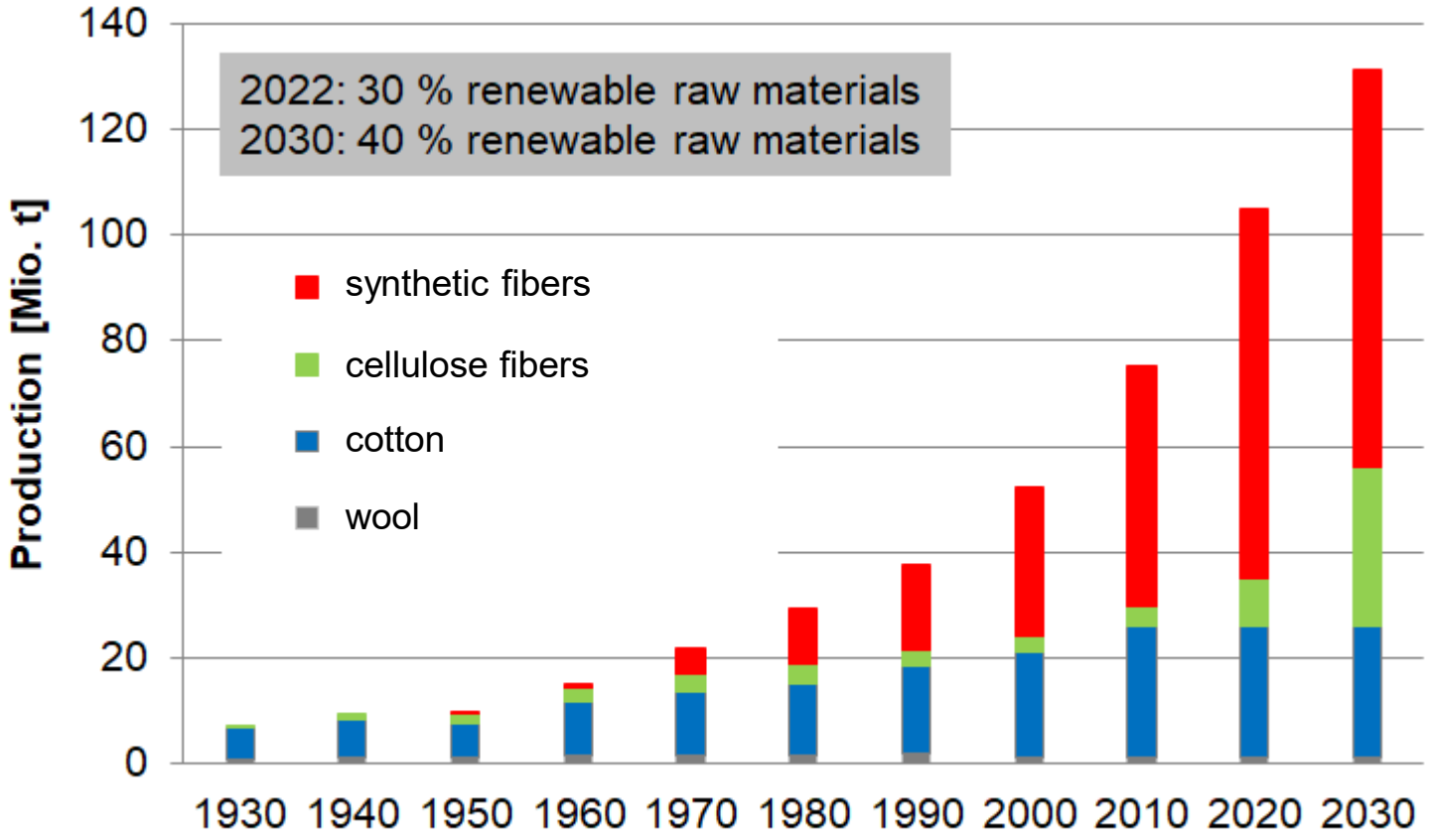
We must act now to mitigate the impact of rising energy prices, diversify our gas supply for next winter, and accelerate the transition to clean energy. The sooner we move to renewables and hydrogen, combined with more energy efficiency, the sooner we will be truly independent and in control of our energy system

Commission President Ursula von der Leyen on REPowerEU: Joint European action for more affordable, secure and sustainable energy - 8. March 2022 (https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1511) -

Accelerating the transformation to sustainability in the textile industry

- 63% of the world fiber market was produced from fossil raw materials (2018)
- Environmental impact of cotton cultivation is enormous
- Ever increasing demand for cellulosic fibers
- Great demand for bio-based polymers

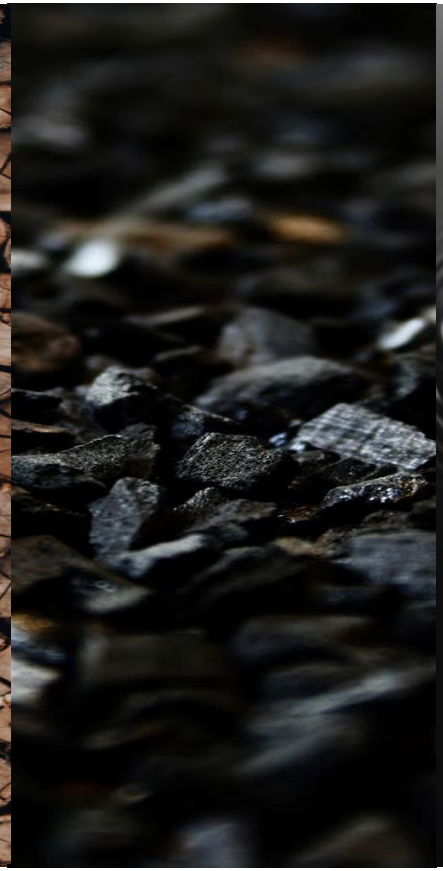
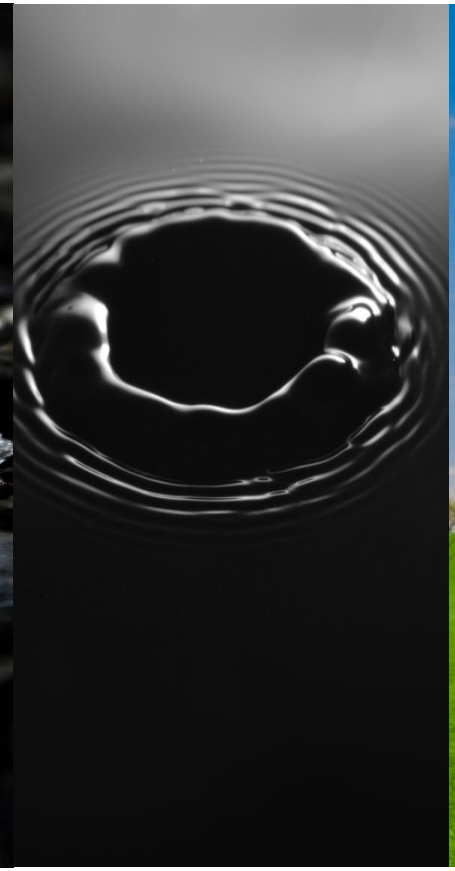
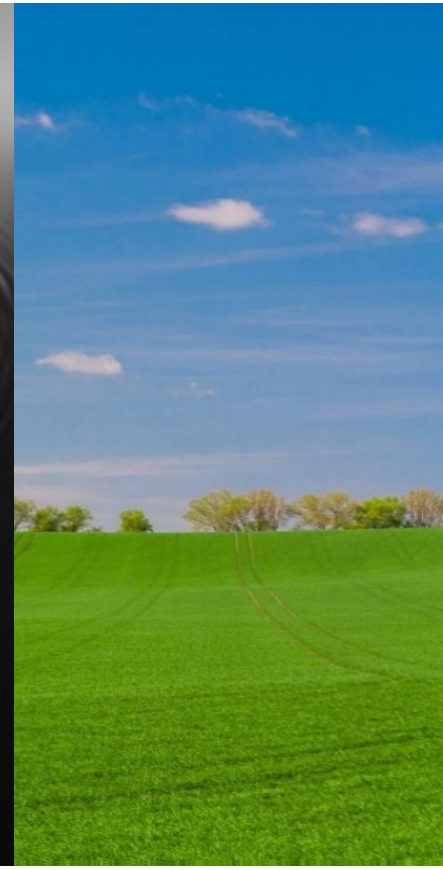
→ drop-in solutions



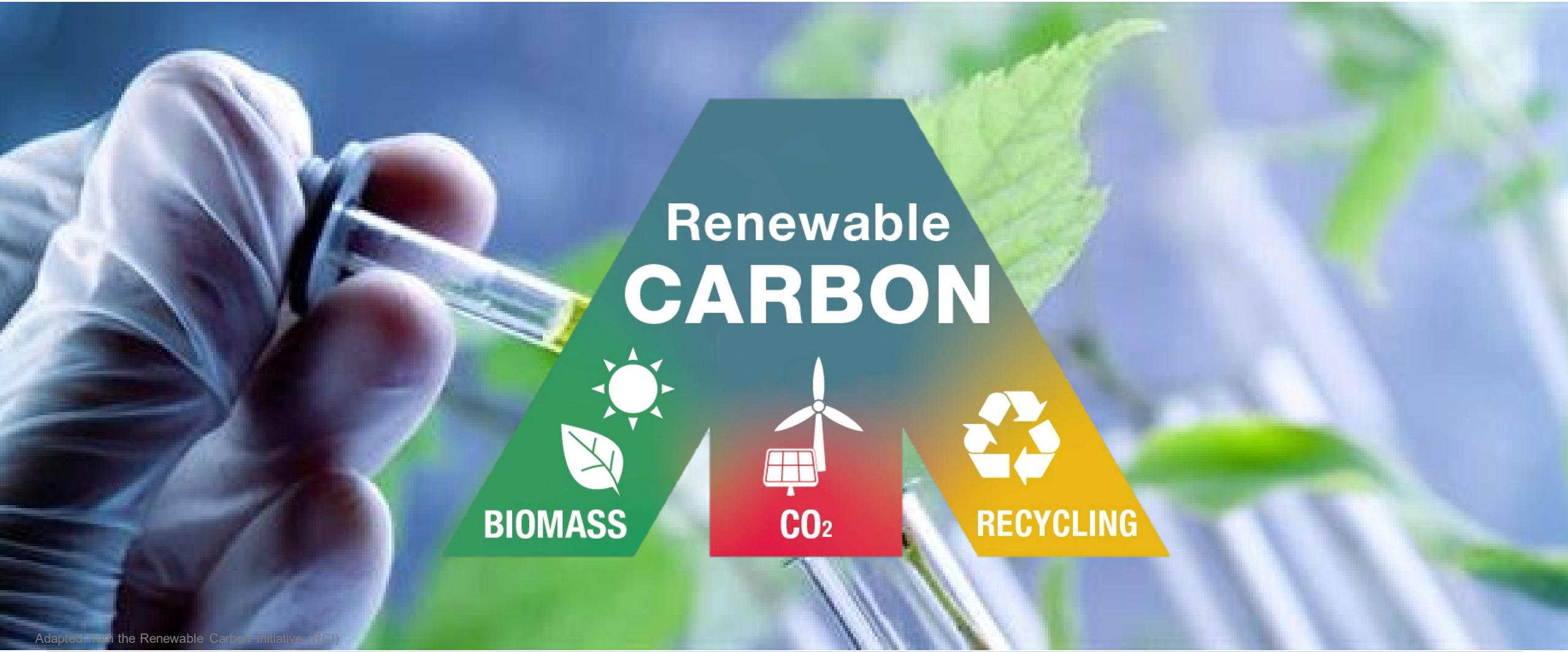
Pathways to implement an EU Textile Strategy

Image: Vladislav Babilenko at unsplash.com

Accelerating the transformation to sustainability in the textile industry

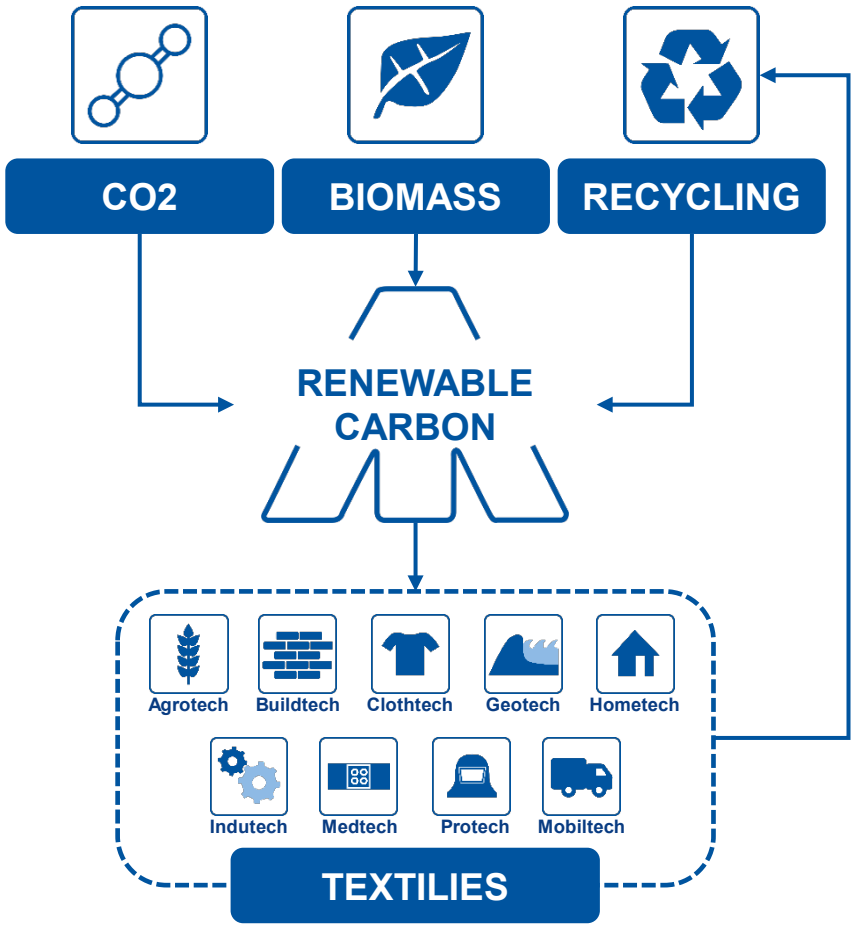
Endemic	Colonial	Wood	Coal	Petro	Bioeconomy
					
<1800	1800	1897	1935	1950	>2020?

Accelerating the transformation to sustainability in the textile industry



Adapted from the Renewable Carbon Initiative (RCI)

We believe in a textile industry based on renewable resources



Adapted from the Renewable Carbon Initiative (RCI)

Our work along the entire textile value chain

- Material, process and product development
- Digitalisation of products and processes
- Business development
- Environmental assessments (e.g. LCA)
- Education

Our working principles

- User acceptance through participation
- Implement a sustainable mind-set
- Connecting actors and stakeholders
- Create qualification systems

Accelerating the transformation to sustainability in the textile industry

Current Research

Accelerating the transformation to sustainability in the textile industry

National funding for biobased and circular economy

BIOTEXFUTURE

BIOTEXFUTURE

Focus: Textile Supply Chain
Polymer/Raw Material to Textile
TRL:1-8

- **Self governing innovationspace**
- **9 active projects**
- **Over 80+ Members**

Become a member!

BioSC

Focus: Plant-/Biobased
Chemicals/Polymers
From plant to polymer
TRL:1-8

Bio4MatPro

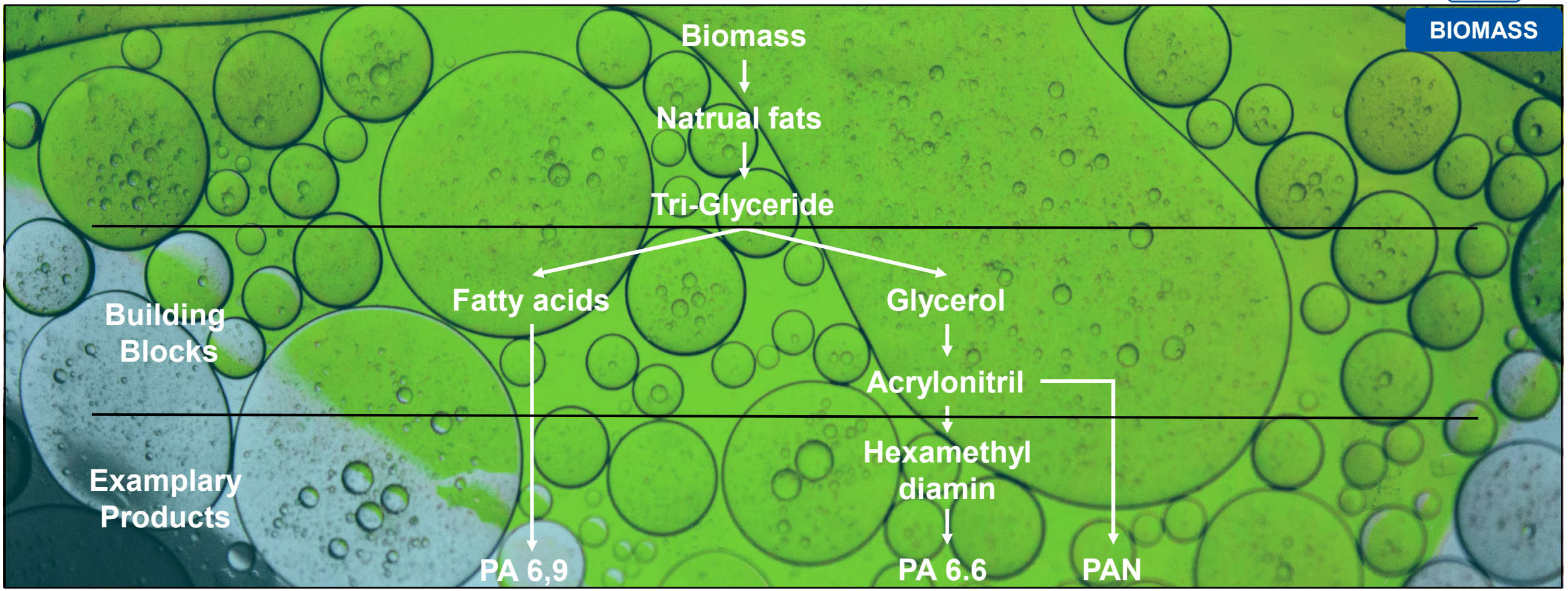
Schwerounkt: Biobased and recyclable products
Waste materials as a resource
TRL:1-8

INGRAIN

Focus: Agriculture/Food/Textiles
Bio-based circular economy
TRL:1-8

Accelerating the transformation to sustainability in the textile industry

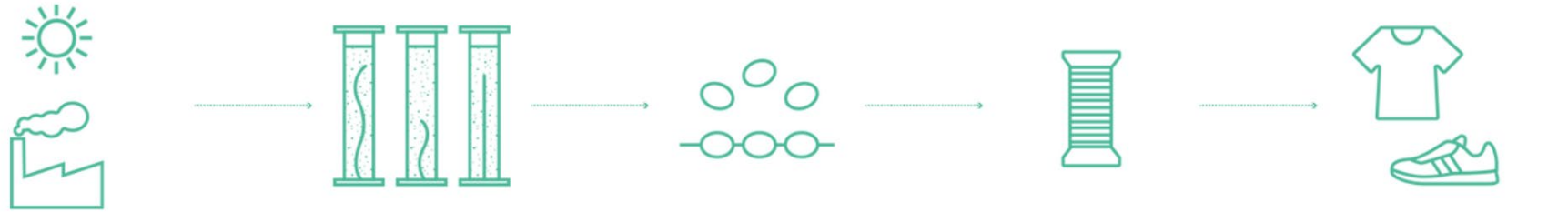
From Biomass to Examplary Products



Accelerating the transformation to sustainability in the textile industry

BIOMASS

Example: AlgaeTex

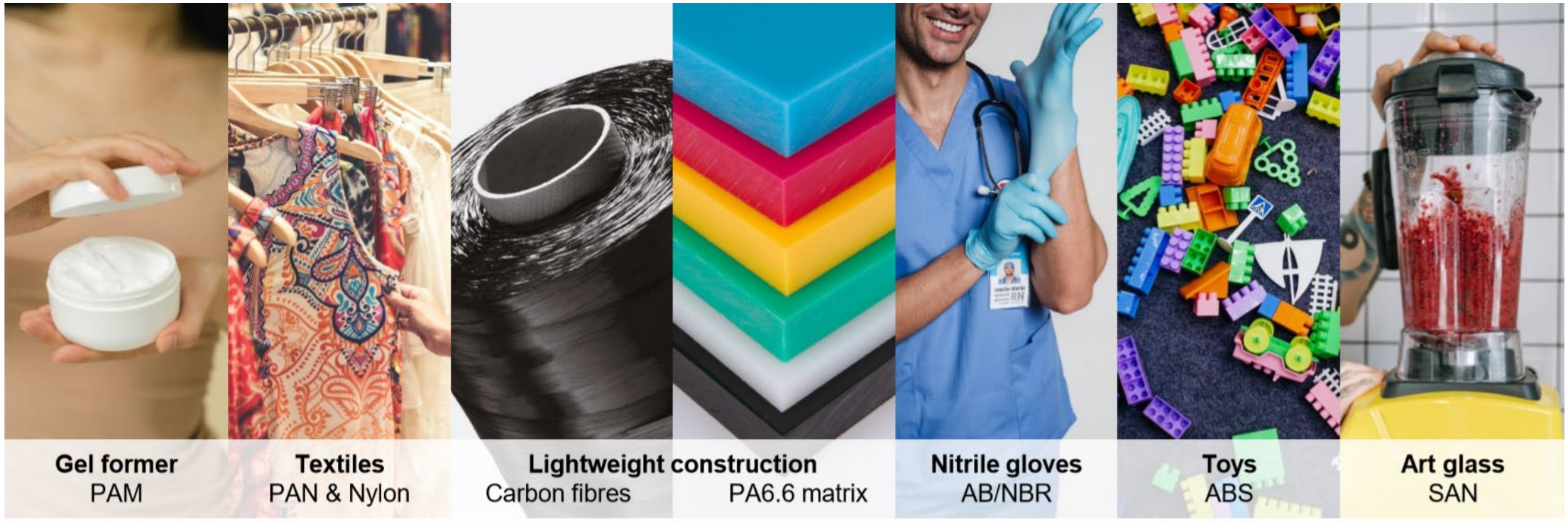


- Testing technical feasibility
- Production of thermoplastic biopolymers from algae
- Demonstrate textile application

Accelerating the transformation to sustainability in the textile industry

Acrylonitrile is a versatile base chemical for…

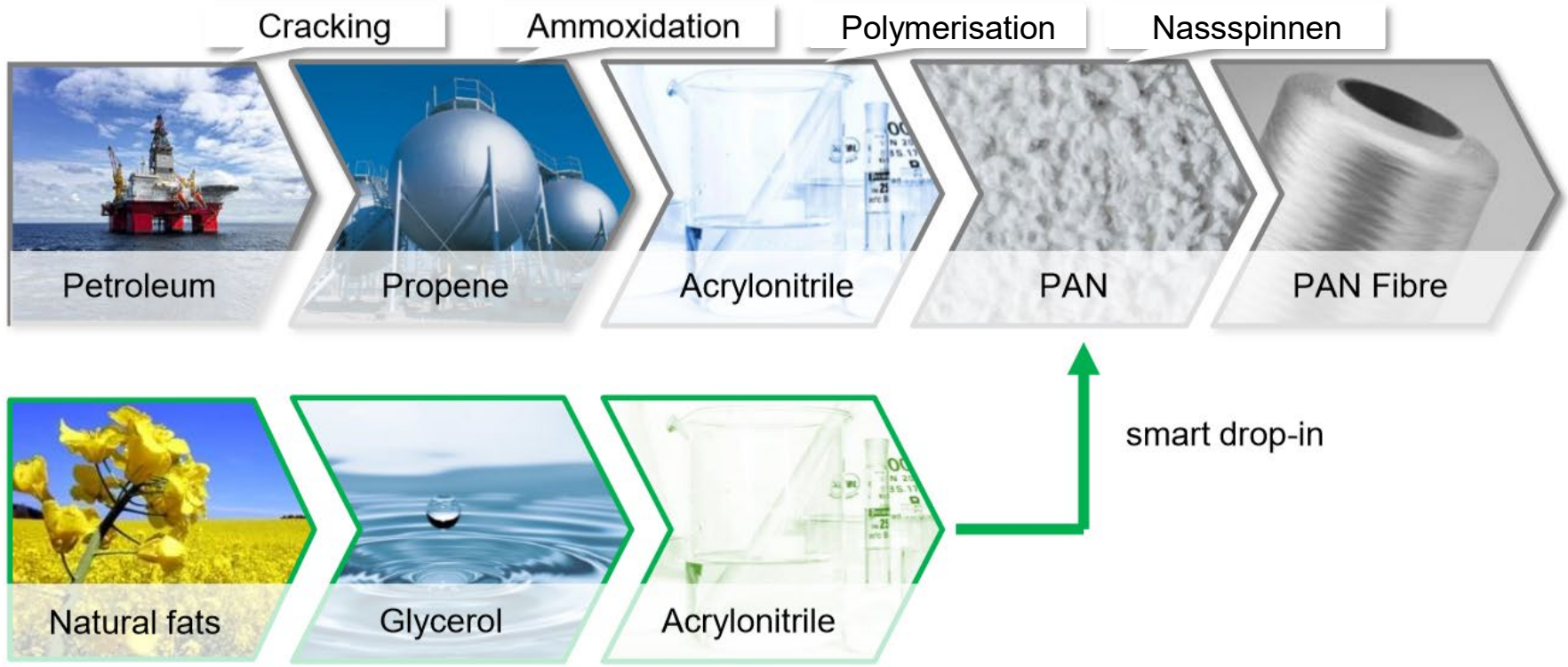
BIOMASS



Green2Black provides proof of concept for further product developments

Example: Green2Black

BIOMASS



Green acrylonitrile is a "smart drop-in" solution for bio-based materials

Bio-based polyethylene is already commercially available

BIOMASS

Sugarcane

Fermentation and distillation

Ethanol

Dehydration

Ethylene

Polymerization

Bio-based PE

Melt Spinning

PE-Precursor

Sulfonation

X-PE

Carbonization

Bio-based Carbon Fiber

Carbon fibers from bio-based PE are cost-efficient and sustainable

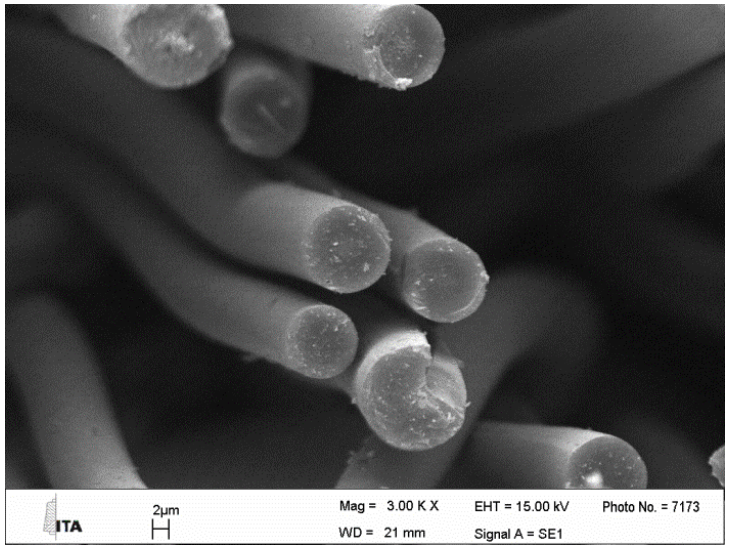
BIOMASS

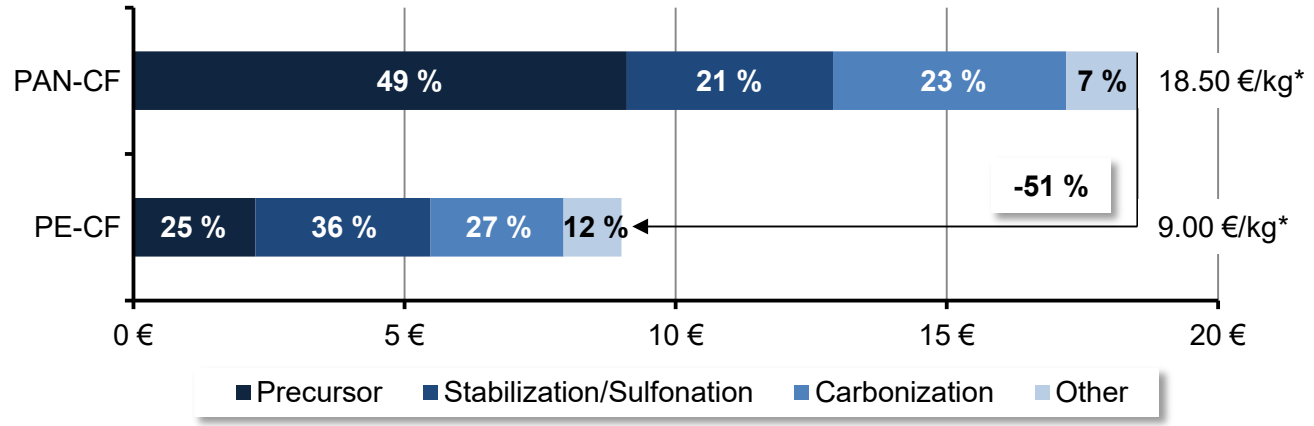
Key Milestones

- Tensile Strength: 1.9 GPa
- Tensile Modulus: 180 GPa

✓ Improved performance expected for new precursor generation

✓ Proof of reproducibility with several precursors





Cost structure comparison of PAN- and PE-based carbon fiber production
*based on a production plant for 1,500 TPY of carbon fibers (including depreciation costs on CAPEX for plant and buildings)

Upscaling of sulfonation technology to industrial scale required

Röding, T.; Langer, J.; Modenesi Barbosa, T.; Gries, T.: A review of polyethylene-based carbon fiber manufacturing.
DOI: 10.1002/appl.202100013

Example: RD&I in Carbon Capture and Use (CO2Tex)

CO2

- Process development: fibers from CO2
- Product development: socks made from these fibers
- Nominated for the "German Future Prize

Development of the entire textile process chain from CO2 extraction to the product

Example: Recycling – Industrial RePAN - Recycling of PAN/Co Production waste

RECYCLING

PAN/Co Production-waste → Solvent based separation → **PAN Pellets** → Spinning → **PAN Fibres** → Further processing → **PAN Demonstrator**

12k RePAN Faser

Approach:

- Solvent based separation of PAN and cellulose
- Spinning the recycled PAN
- Processing to finished products

RECYCLING

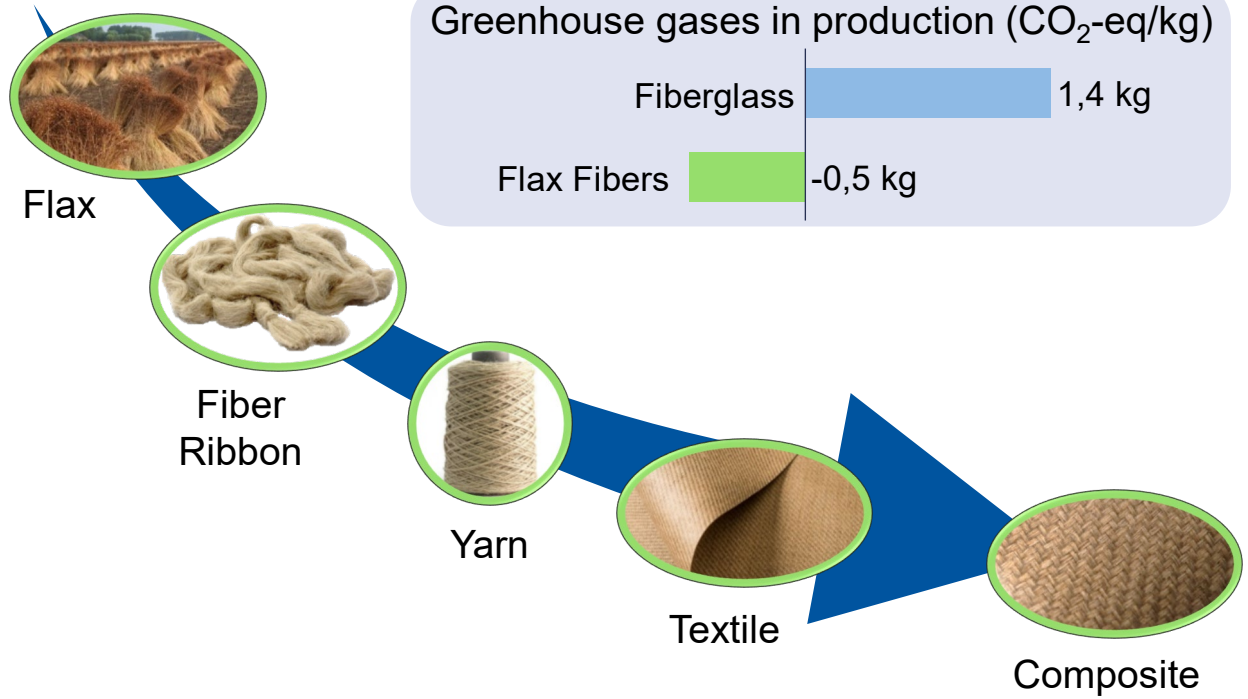
Example: Recycling-Atelier in Augsburg

- New recycling processes
- Closed process chains
- Digitalization of the recycling process

Opening 20.June.2022

Use of renewable (fiber) raw materials

Substitution of glass fibers with natural fibers

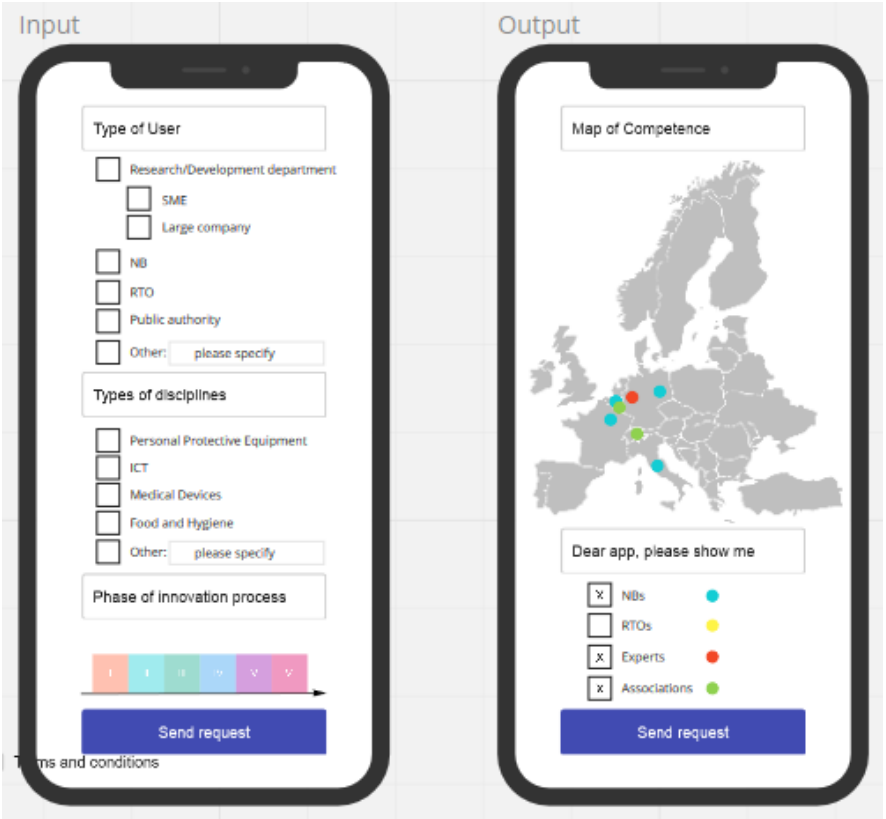


Accelerating the transformation to sustainability in the textile industry

Example: Digitization - CISUFLO [3)]

- Expand and ensure range of **sustainable flooring products**
- Meet quality and performance standards
- ITA as Task Leader - "Systemic Transition Support Tool".
- Electronic passport + "ePRODIS" database

CISUFLO
CIRCULAR SUSTAINABLE FLOOR COVERINGS



3) https://www.cisuflo.eu/pilots/

Dieses Projekt wurde mit Mitteln aus dem Forschungs- und Innovationsprogramm Horizont 2020 der Europäischen Union unter der Finanzhilfevereinbarung Nr. 101003893 gefördert.

Cooperation

New forms of cooperation between companies

Value chains become networks

- Cooperation in open eco-systems
- Digital platforms for the interconnection of companies and networks
- Cooperation of young companies/startups with established companies and corporations
- Matchmaking events: getting to know each other personally and gaining trust

Co-Working

Transdisciplinary collaboration

Across corporate and social boundaries

- Researchers, people from different companies, users form a temporary team

  - Open Innovation, Customer Co-Creation

- Living labs or real labs places for:

  - Conceptualization

  - Research

  - Implementation

  - Evaluation

- Example: Regional Competence Center for Labor Research WIRKsam: AI in the Rhenish Textile Industry

Qualification

Digitization is changing our job profiles

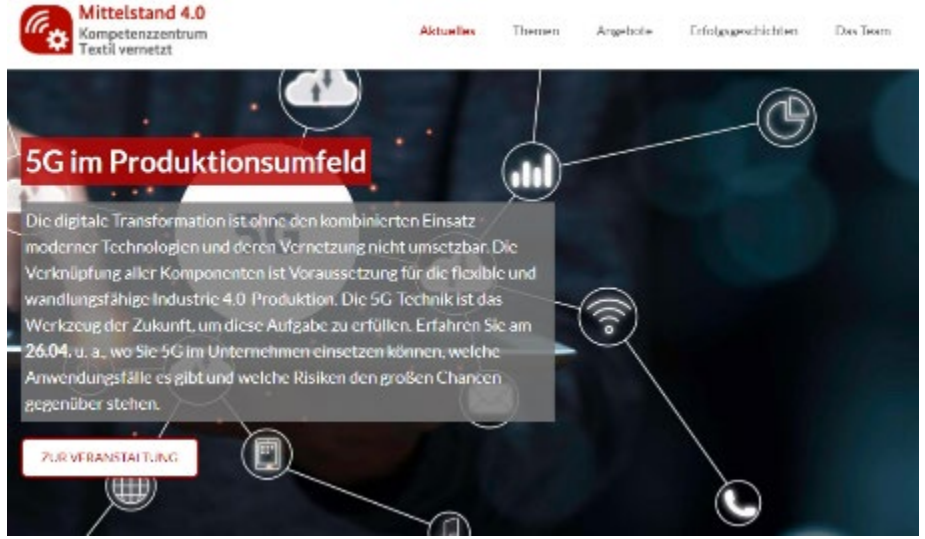
Information and Qualification

Low-threshold offers

Publicly (co-)funded competence centers

- e.g. **Competence Center Textile connects**

- Lernfabriken und Trainingszentren
  - e.g. the **DCC Digital Capability Center Aachen**
    (Member of the International Association of Learning Factories)



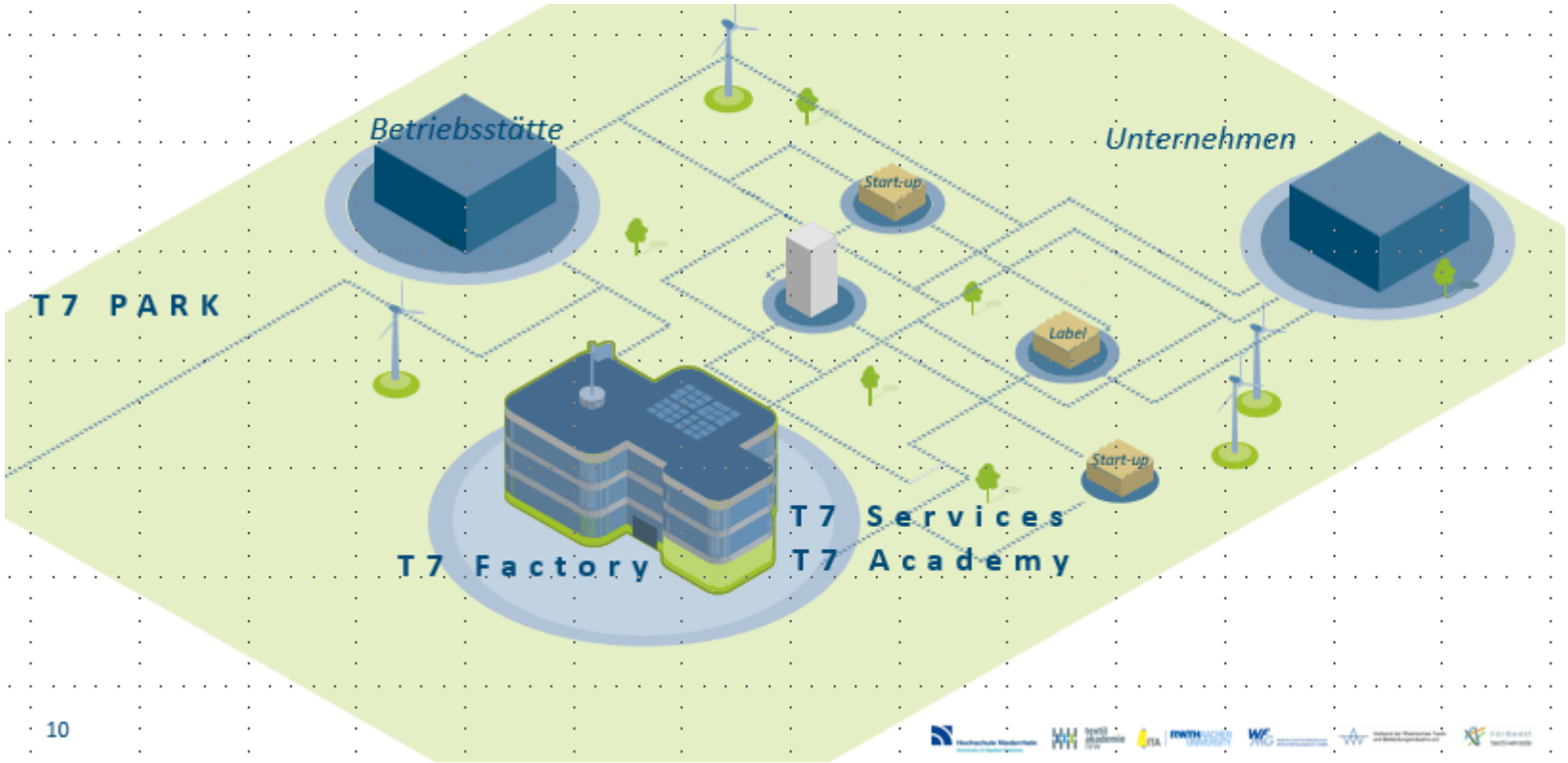
Business Models

New business models - new operator models - new structures

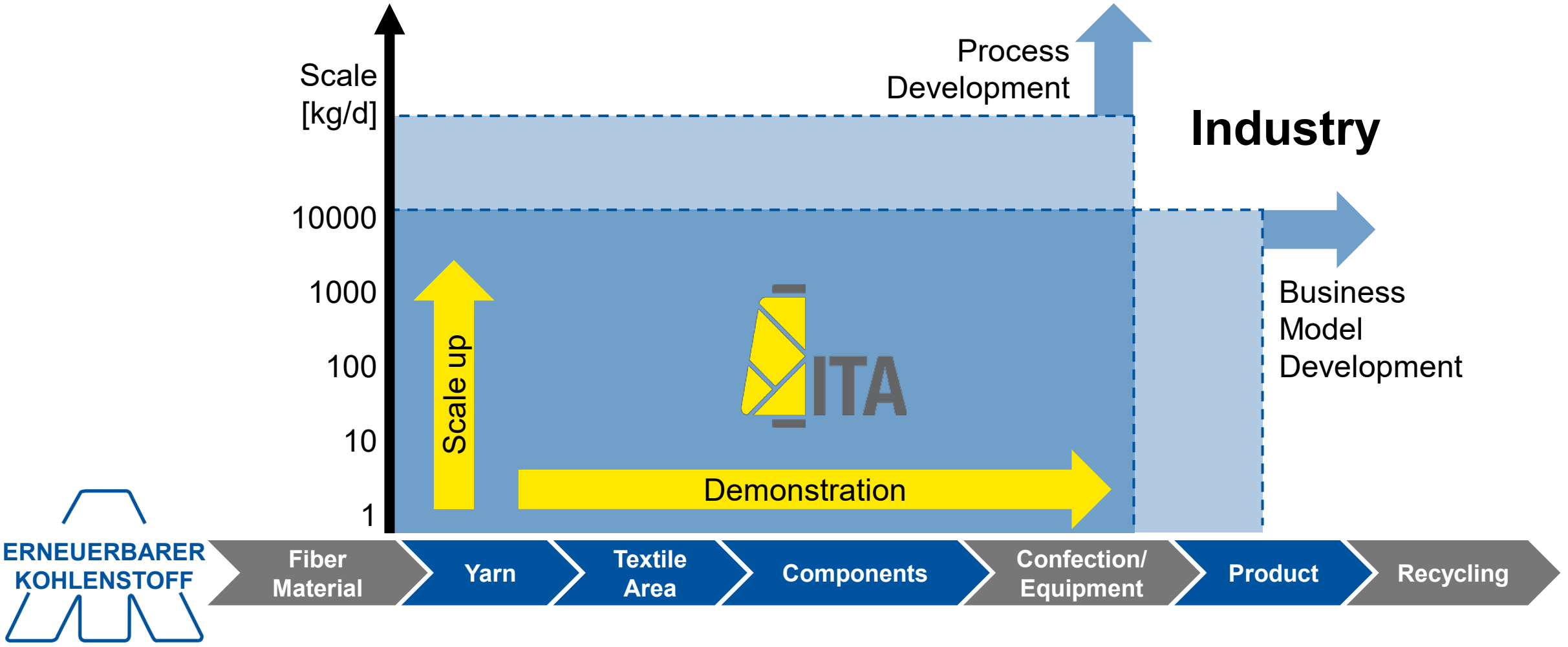
- Innovative business parks
- Subtitle
- Micro-factories
- Manufacturing on demand
- Pay per use
- Solution provider
- Rent instead of buy
- Custom
- Cloud services
- Crowd funding

T7 Park

Establishment of an emission-free, digitalized innovation and industrial park (approx. 20 ha) in Mönchengladbach - **for companies in the textile and clothing industry**



Textile Structures – Our Value Proposition



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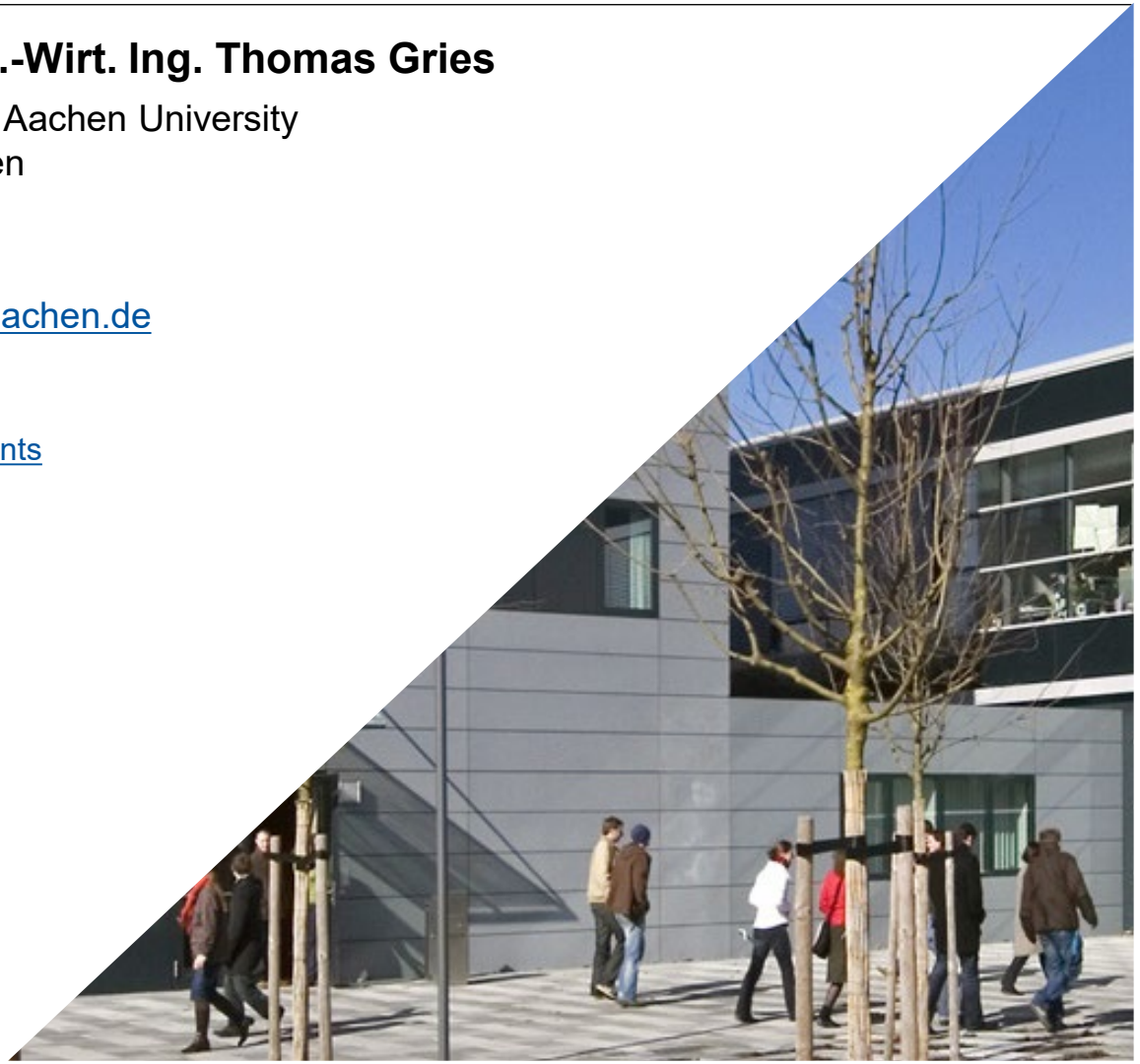

Thank you for your attention!

www.ita.rwth-aachen.de