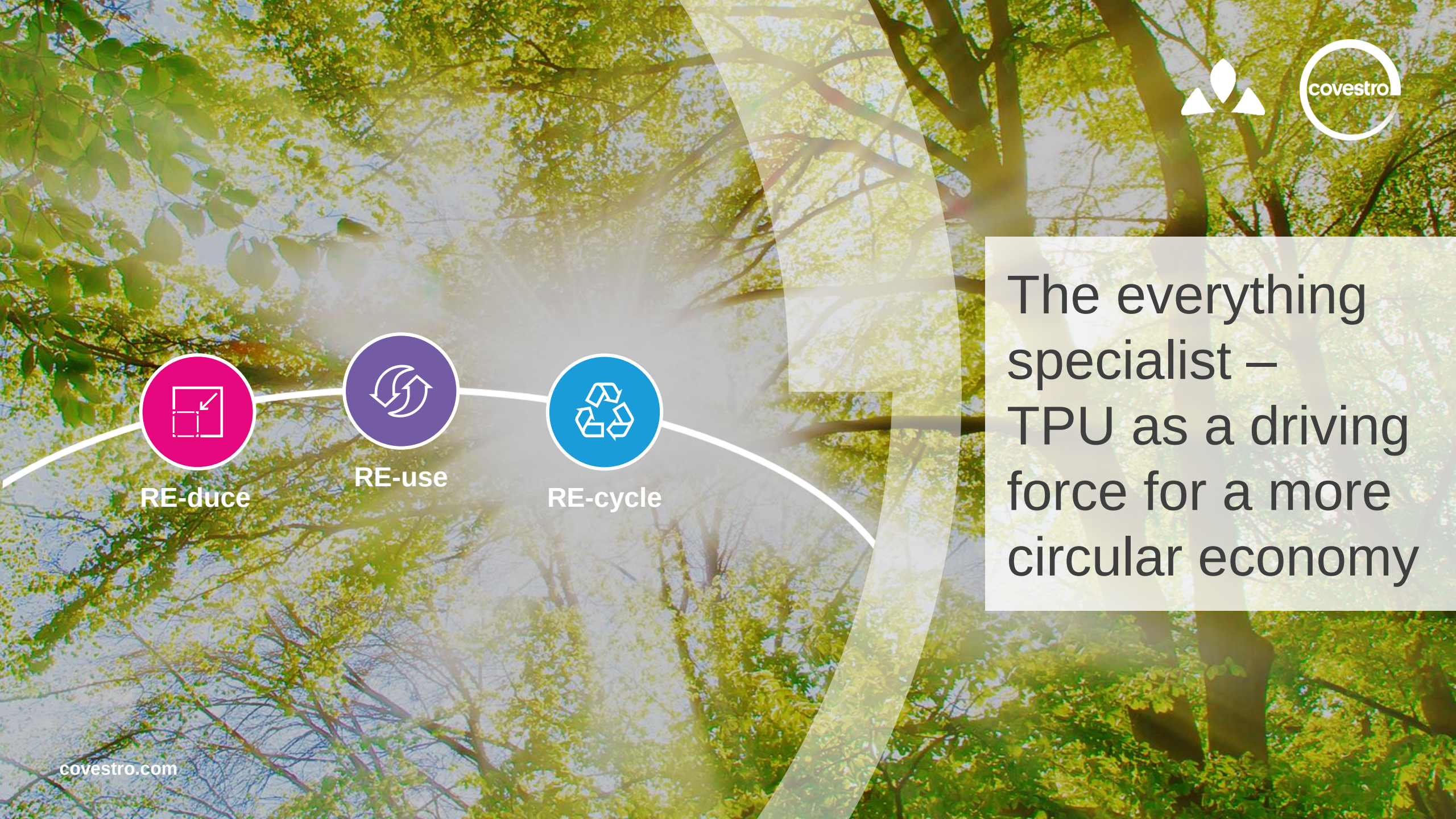

The everything specialist – TPU as a driving force for a more circular economy

covestro.com

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Agenda

01	The Circular Economy challenge
02	Introduction to TPU
03	Portfolio of solutions driving circularity
04	Partnering with VAUDE
05	Q&A

01 THE CIRCULAR ECONOMY CHALLENGE

New guiding principle

Consumption, production and value creation must change

Global challenges call for fundamental rethink of approaches

Climate change, disturbed ecosystems

Scarce resources for growing world population

Apply Circular Economy as guiding principle

Leave consumption and production geared to one-off use

Avoid waste as much as possible

Stop wasting, burning or loosing carbon without recovery

Establish enduring value creation cycles

Crucial role of plastics

Essential to drive resource-efficient Circular Economy

Plastics:

more and more needed for climate neutral world

02 INTRODUCTION TO TPU

The everything specialist for high-value TPU applications

Thermoplastic Polyurethanes (TPU) at a glance

Product

Thermoplastic polyurethane (TPU) has high wear resistance, flexibility over a wide range of temperatures, and high elasticity over the entire hardness range.

Its proprieties can be changed by the selection of raw-materials, which give the TPUs a rich variety and versatility.

TPUs can be found in sports equipment, vehicles, construction and electronic devices.

Key customer industries

Sample applications

Sports & Leisure

Electronics & Electronic Accessories

Industrial & Agriculture

Film & Sheets

Current nomenclature

Thermoplastic Polyurethanes (TPU) at a glance

The number contains only four digits followed by one or two letters

E.g.: Desmopan® 1 3 50 D

- 1 — Number of series
- 3 — Processing- and characteristics information
- 50 — Hardness of product
- D — Kind of Shore - hardness

- The 1st first digit shows the series and gives an overview about the main properties
- The 2nd digit informs about processing or properties
- Digit 3 and 4 together in combination with the following first letter show the hardness in Shore A or D

Current nomenclature with other Isocyanates

Thermoplastic Polyurethanes (TPU) at a glance

Product series
100 esters
200 esters
300 esters
400 special esters
500 special esters
600 ethers
700 carbonates
800 aliphatics
900 ether

E.g.: Desmopan® EC 3 3 0 85 A U DPS300

- UV-Package
- Shore - hardness
- Hardness of product
- Processing- and characteristics information
- Product series analogically MDI Products
- Product series
  - (3000 based on renewable raw materials)
  - (4000 based on NDI)
  - (8000 based on HDI [aliphatic])

- The 1st digit describes the specially used raw material
- The 2nd digit describes the product series analogically the MDI products
- The rest analogically the four digit nomenclature

03 PORTFOLIO OF SOLUTIONS DRIVING CIRCULARITY

Using carbon from alternative sources to close the carbon loop

Contributing to the Sustainable Development Goals

BIOMASS

e.g., Desmopan EC Series with up to 60% carbon content from biomass

CO_2

e.g., plastic components with up to 20% of CO_2 in the cardyon® polyol

RECYCLING

e.g., portfolio of recycled TPU grades Desmopan® RC

MASS BALANCING

e.g., using 60% bio-attributed MDI"

Covestro TPU is pushing boundaries in sustainability

Desmopan® EC – 33xxx series – Bio-Based TPU

- High renewable content: Up to about 60% of the carbon content of Desmopan® EC series is sourced from biomass.
- Low carbon footprint: Reduction in carbon footprint can be higher than 20%.
- High quality material: Same outstanding performance as fossil-based alternatives.
- Bluesign® label: Available Desmopan® EC products, which are approved by Bluesign® system.

New sustainable innovation in industrial processes

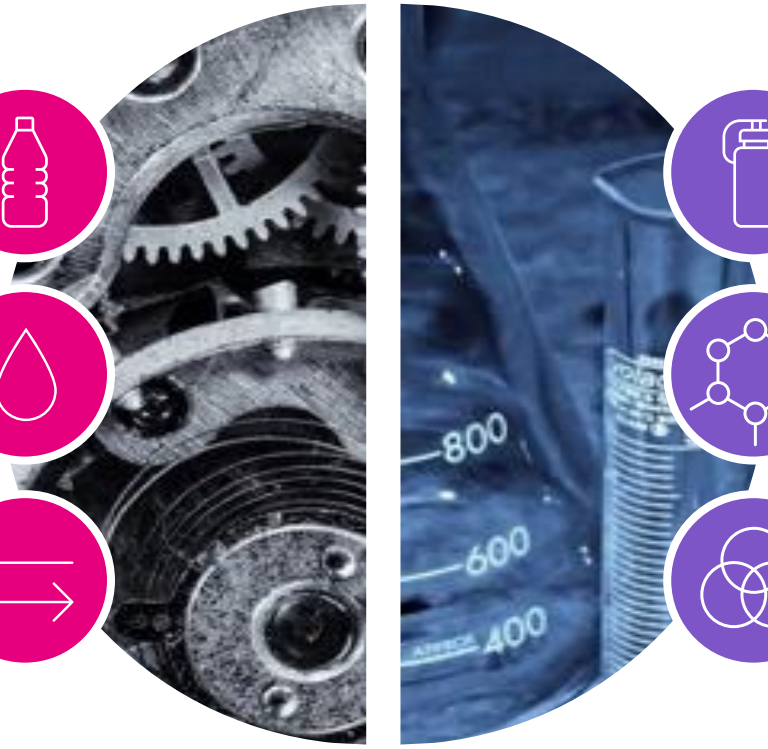
Desmopan® 37385A - Products based on cardyon® polyol

Inspired by nature, we are able to replace up to 20% of fossil feedstock with CO_2 in polyol production. With an improved sustainability performance, Covestro can deliver a positive environmental impact – without compromising quality.

Mechanical and chemical recycling

MECHANICAL RECYCLING

- Requires clean sources of pure / rich polymers
- Washed, cleaned up polymer flake for recycling
- Material knowledge required for application design



CHEMICAL RECYCLING

- Process enables broader mix of inputs
- Broken down chemically, virgin like material
- Indistinguishable from virgin materials

Mechanical and chemical recycling complement each other.
When possible, we apply mechanical recycling

Covestro TPU is pushing boundaries in sustainability

Desmopan® RC series – Recycled material, based in TPU products

- Desmopan® RC100-80D is fully obtained from post-industrial scrap of Copolymer blend (Polyester and TPU polyether).
- High stiffness material, Flexural Modulus 1.4GPa.
- Good hydrolysis resistance
- Good impact resistance
- Very good process behavior for injection molding and extrusion as well.

Chemical competence

Researching new recycling technologies

Work on developing new solutions for plastics recycling

Expand technology platform

Bring required technologies quickly to market

Technological diversity as prerequisite

Bring in chemical competence to advance technologies

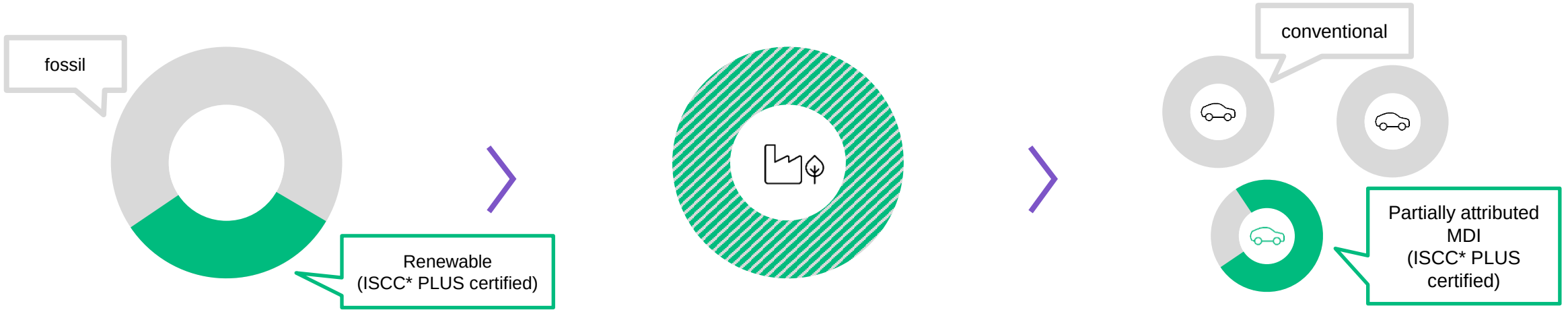
Maintain the polymer with mechanical recycling

Get back to the molecules with chemolysis, enzymatic recycling, smart pyrolysis

Introduction to mass balancing

The mass balance approach

Feedstock	Value chain	Products



Substitution of fossil feedstock by renewable feedstock in petrochemical production

Co-feeding fossil based and renewable raw materials into existing plants all along the value chain

Attribution of the renewable content to dedicated products according chemical feasibility

* ISCC=international sustainability & carbon certification

Let’s work together and join us in shaping the circular economy

Let’s imagine how a brighter world feels like

Procurement Director

“Increase renewable material in their portfolio”

Production Manager

“Easy to implement with no process interruption”

Quality assurance engineer

“No compromises on quality and performance”

Sustainability Manager

“Lower carbon footprint in scope 3 emissions”

Brand Manager

“Engaging story to tell with a real impact”

04 PARTNERING WITH VAUDE

Family-owned company

1974 Albrecht von Dewitz founds the company
2009 Antje von Dewitz becomes CEO

100 % family-owned
> 550 employees

Where we are coming from

In 2019, Desmopan grade in Skarvan shoe for heel counter / toe cap
VAUDE objective to achieve 50 % biobased content in midsole

Inspired by nature

Bio-based feedstock for the mid sole of the VAUDE hiking boots

1st biobased VAUDE outdoor shoe

Lavik eco stx – For easy yet active mountain tours

Key benefits of the product

Desmopan® EC 33000

Non-GMO bio-based
Desmopan® EC 33000 TPU offers non-GMO bio-based chemical feedstock.

Low-carbon
EC range reduces the carbon footprint by more than 20% compared to fossil TPU.

Highly durable
Desmopan® EC TPUs resist abrasion, oils, solvents and weathering.

Drop-in
Bio-based feedstocks work in existing processing systems with no new investment.

Collaborative
New bio-based chemical feedstock grades can be created with value chain partners.

Close cooperation along the value chain is the key to success

Partnership between VAUDE and Covestro

- Share a **vision** on using more materials from renewable resources
- Support each other to **reach the sustainability goals**
- Combine all kinds of renewable raw materials, reducing **CO_2 footprint** without compromising **performance**
- Improve **transparency** by 3rd party certification, proof via LCA and optimize for further reduction
- Offer a **customer oriented** (end-)product

Q&A

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