



Embracing Circular Design for Sustainable Futures

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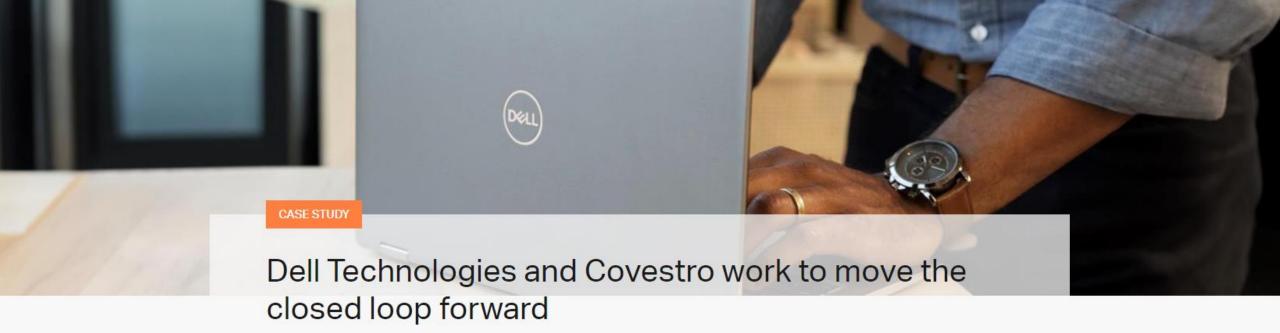
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▲ Global E-waste Generated by year





At Covestro, innovative recycling is a priority, plastic waste is a valuable raw material, and the path to circularity is possible. To show this, Covestro and Dell Technologies worked together to address some of today's toughest questions around closed loop recycling of notebooks.







Task

Identify a supply of high-purity materials and ensure the preservation of engineering properties during closed loop recycling

Regulatory and business pressure is mounting.

Governments around the world have been setting ambitious goals on recycling and carbon emission reduction. These new goals are having a direct impact on the electrical and electronics industry. Leading brands are moving towards circular economy business models like designing for disassembly and using recycled materials, extending the life cycles of their products, and enabling take-back systems to properly collect and recycle used products.

Reduce landfill by 50% and recycle plastics by 100%.

The European Union

Achieve a 65% municipal waste recycling rate.

2025



2030 2035





2050



2060

Japan

Reduce plastic waste by 25%.

The Netherlands

Reduce the use of raw materials (including minerals, fossil fuels, and metals) by 50%.

The European Union

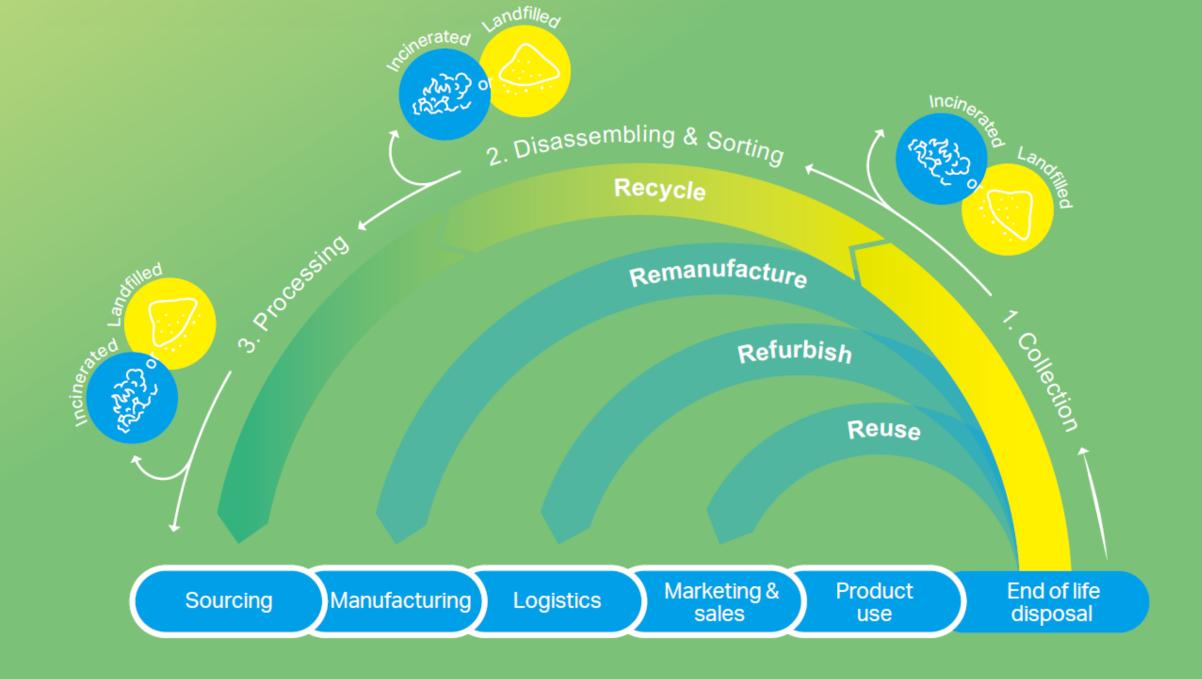
Achieve carbon neutrality

US

Achieve 100% clean energy economy and net-zero emissions

China

Achieve carbon neutrality



Introduction

The guide shows how to select sustainable materials, and lets designers understand the basics of a circular economy.

Chapter 01
Linear to Circular

Target Audience

Designers, engineers, R&D, Procurement staff etc.

Circular Design Guidebook

Chapter 02
Circular Design

Goal

- The first design guide for material selection.
- A tool to introduce and adopt circular design principles.
- A communication tool for discussing materials with clients.
- Can be used for lectures and workshops.

Chapter 03
Material selection from the perspective of sustainability

Linear to Circular

Motivations

Resource and e-waste issues, and circular economy policy trends, as key motivation to push for change in Electronic, Electrical and Appliance industry.



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Circular Design

Methodologies

Integration and mapping of business models with circular design strategy along with value chain.

Material selection from the perspective of sustainability

A Practical Tool

The selection process with worksheets for internal case study to achieve a more circular designed product.



The key to solving the problem of material waste is to consider the end of product life in the initial design phase to facilitate recycling.

Lily Wang

President of Business Entity Engineering Plastics, Covestro





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framework





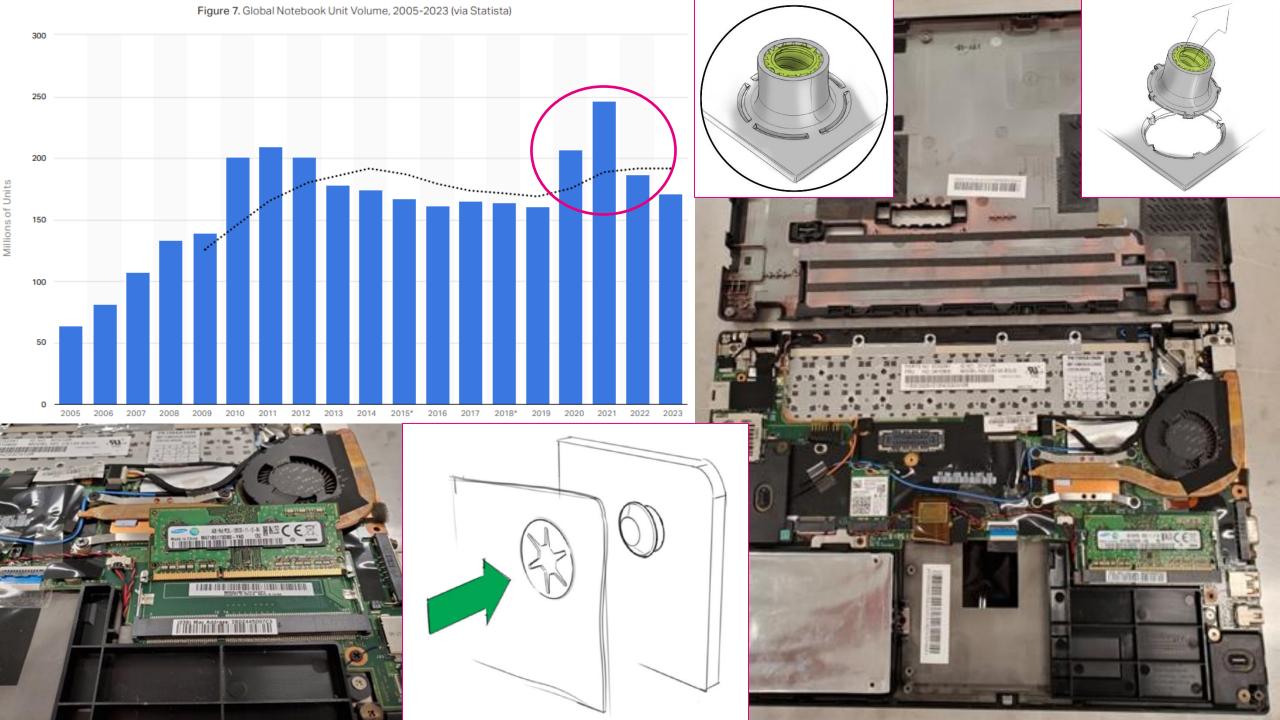




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Design will play a key role in the process of circular economy transformation

Covestro and REnato Lab launch Circular Design Guide



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Laptop / Notebook

Design for easy recycling and disassembly





Drug injection pen
Single material design for easy recycling





Task

Material solutions support module design of Fairphone 4, and help Fairphone develop circular economy.



With the help of our post-consumer recycling portfolio, we support Fairphone in achieving its sustainability goals. This includes particularly robust material solutions that enable a modular design of Fairphone products and promote repairability.









Take a peek into the life journey of PC (polycarbonate)







Sustainability Solutions Engineering Plastics



One night in 2024, Roy and friends had a delicious meal at a restaurant.

and fats, such as used cooking oil or residues from vegetable oil

processing, are collected

centrally and sent to

processing facilities.



Mass balance

A chain of custody method used in various industries where it's not feasible to keep sustainable and conventional materials physically separate during processing. This approach is crucial for transitioning to a sustainable and circular economy, as it allows for the co-processing of alternative materials and is certified by ISCC PLUS.

 \Box

VVVV



Bio-circular VS Bio-based feedstocks

Bio-circular feedstocks avoid competition with food sources as are not intentionally produced for human or animal consumption.



The RE series is introduced to the market and used in products such as charging stations, routers, switch and sockets, architectural mesh etc.



RE series (bio-circular attributed PC)

Such renewable feedstocks are used in chemical plants to produce RE series (bio-circular attributed PC).



At processing facilities, such bio-circular raw materials are refined as renewable alternatives to non-renewable fossil resources.





K E Series

Bio-circular PC

Bio-circular sources replace fossil resources ISCC Plus certified

Reduced carbon footprint
Same material performance as
"virgin" (fossil fuel-based)



Since 2022, it has been widely used by more than 30 well-known brands



















On a journey to go full circle

- We're on a journey towards replacing fossil-based plastics with certified bio-circular plastics which will lead to estimated yearly savings of ~400 tons of CO2 equivalent by 2030
- Based on the projected average sales volume of SAGA™ products, more than 75% will use ISCC PLUS certified material





- ISCC PLUS certified sustainable share of up to 88% of manufactured product*
- Reduction in the carbon footprint of the base polymer material by up to 80%
- Features high performance Makrolon® RE polycarbonate from Covestro
- 100% chemically identical to incumbent fossil equivalent
- A true drop-in solution with no process interruption
- LEED-enabled, circular economy, supports GHG reduction targets
- Pioneering nil-waste liquid-state manufacturing process
- 70% reduction in solar gain on exterior installations

*calculated using ISCC PLUS v3.4



More than a decade later, the product enters end of its life cycle, and now mid-aged Roy disposes the product into a recycle bin which later goes to recycling facilities.



Circular Design Strategy

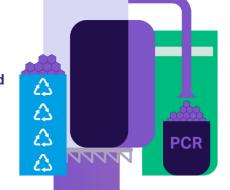
Modular Design
Dematerialization
Circular Material Choices
Product Life Extension
Product as a Service



The aesthetics and CMF of R series

Consumers often embrace the unique aesthetics of R series, as mechanically recycled feedstock would create impacts on color matching of the materials and products. Such CMF aesthetics of R series are unique – "perfectly imperfect".

Recycled materials are re-granulated in PC production and compounding facilities and turned into R-series (post-consumer recycled PC).



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R-series (post-consumer recycled PC)





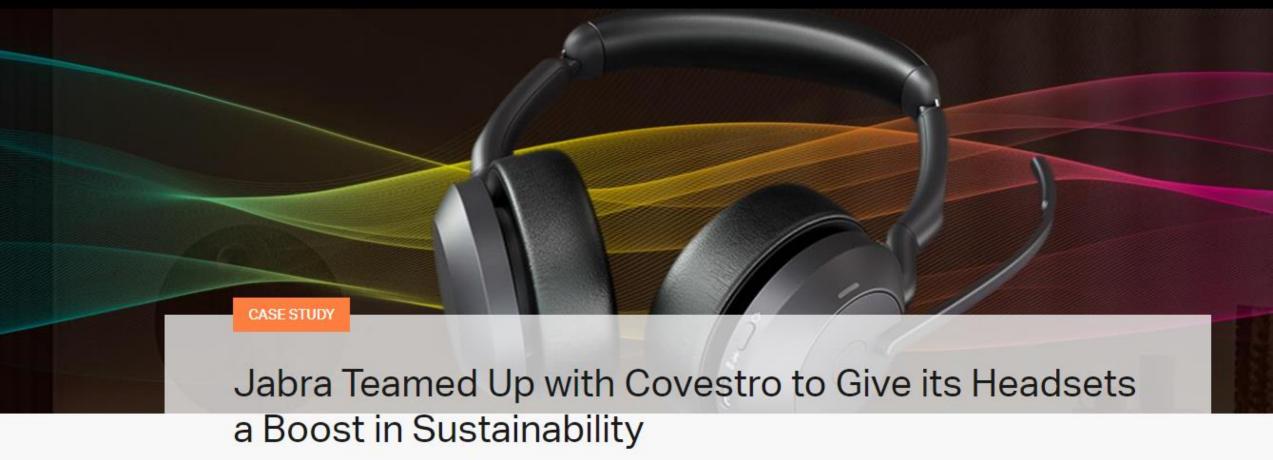
In order to ensure the physical properties of R series, the current proportion of mechanically recycled content ranges from 25% to 90%.

Industries

Materials

Products

Inspiration





Covestro's post-consumer recycled (PCR) polycarbonate with 75% recycled content enabled a lower carbon footprint for Jabra's new Evolve2 mid-range headset series while meeting all the functionality needs.

Aesthetics of recycling

Through CMF design, the unique aesthetic characteristics of recycled materials are conveyed



Mixed color plastic regrind

Mixed-color plastic regrind are usually added with black or gray pigments to produce black/gray feedstock.

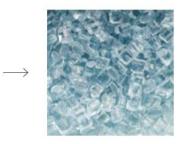




Sorted plastic regrind

Sorted plastic regrind such as water barrels are directly processed into color-tinted transparent feedstock.





Transparent plastic regrind

Transparent plastic regrind such as auto headlamps and construction sheets are directly processed into transparent feedstock.









Above QR code is for WeChat

Stone - Marble









In collaboration with renowned universities in China and Italy, we conducted research to explore the meaning of "sustainable design" in Eastern and Western cultures, and translated it into CMF design, incorporating more sustainable materials





Using Nongfu Spring EOL 5-gal water bottles and collaborating with companies such as Ali Cloud Energy Treasure, enhances traceability and helps brand promotion









本低碳商品由阿里云能耗宝完成碳足迹核算

每支减少碳排放约5.85g

点击查看碳足迹 →



大约可以减少碳排放1825g, 大约相当于普通小汽车行驶5km的碳排放量。







"从规算到大门"的LCA生命尚期评估。 该LCA计算方法已经常四条的TÜV从证。





农夫山泉 NONGFU SPRING





re.glow | de.light





INDEED



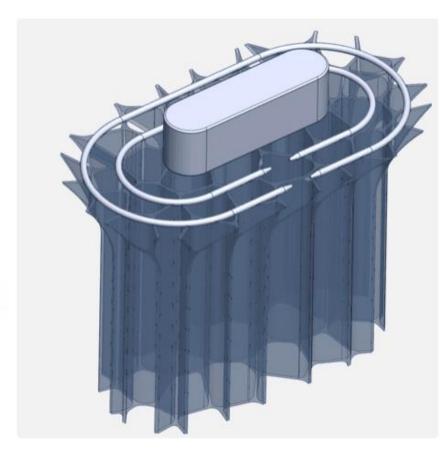
Based on the unique translucent visual effect of Covestro's "Reborn Cyan" aka "No makeup" recycled materials, as well as the freedom of 3D printing, on the basis of a digital and rational look and feel, the lamp integrates a gentle and rounded traditional lamp stand shape, leaving people with full imagination.

Jellyfish lamp structure









INDEED

"New Reborn" Circular Chair

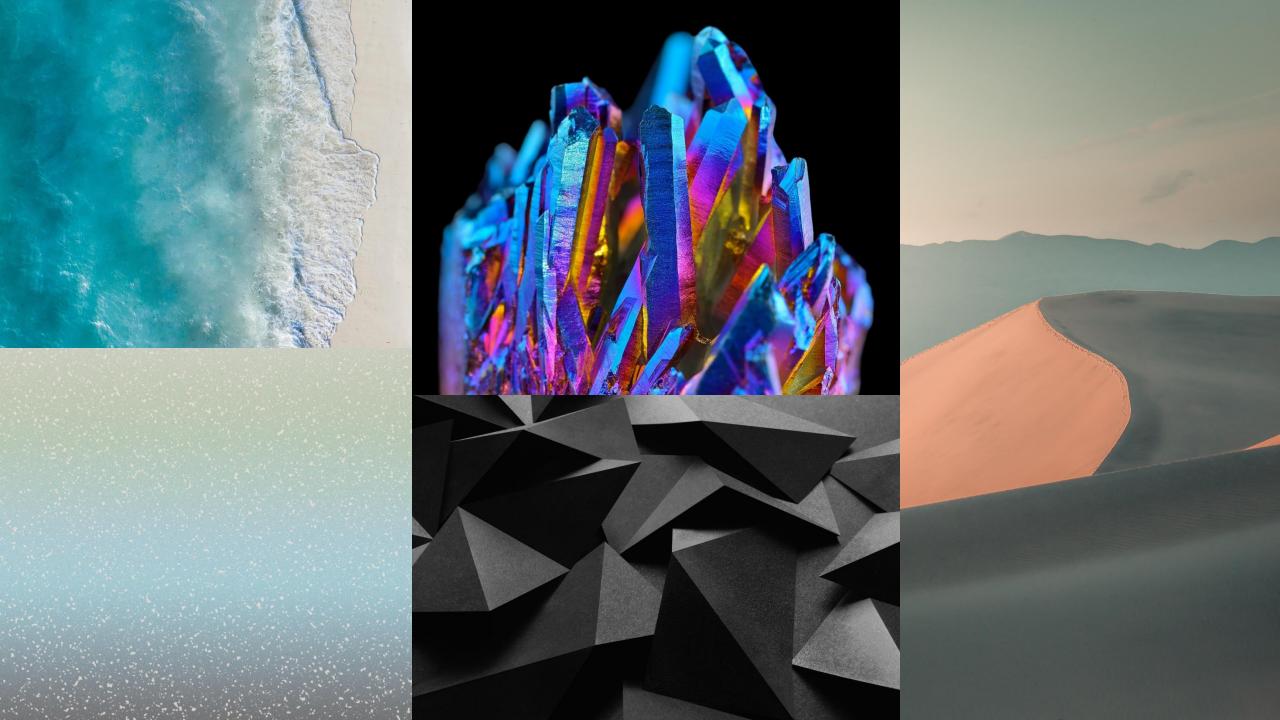












CMF Design for Recycled Materials

Convey the characteristics & value of recycled materials through aesthetics



For the European and American markets, we investigated the western understanding of "circular design" in cooperation with well-known universities in Milan, Italy, generating CMF design guidelines through trend research





M.AI2497 RE 23F120M



M.AI2457 RE 23F110M





M.2407 RE 23F108M



B.T85 X RE 23F111B





M.Al2417 RE 755305



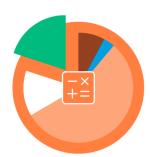
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More than another decade later, the R-Series products have reached the end of their life cycle, and now senior Roy recycles the products through a recycling platform.

> Such plastic waste is a raw material recovered through chemical processes such as pyrolysis and dissolutions in chemical recycling facilities.



LCA: A life cycle assessment

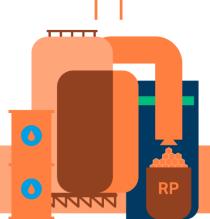
LCA: A life cycle assessment (also known as an environmental assessment or ecological assessment) is a systematic analysis of the potential environmental impacts and energy balance of products during their entire life cycle.

The RP series is polycarbonate attributed with chemically recycled post-consumer waste. This process is tracked and certified by ISCC PLUS.





RP series (chemically recycled attributed PC)







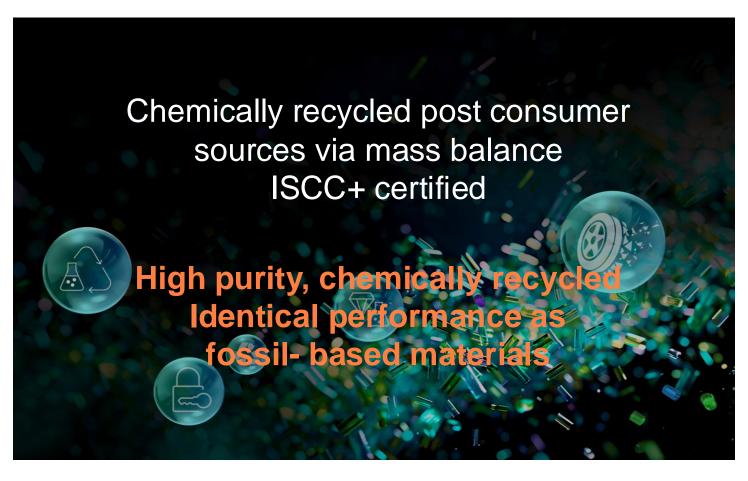


RPSeries

covestro

Customer pilots started in 2024

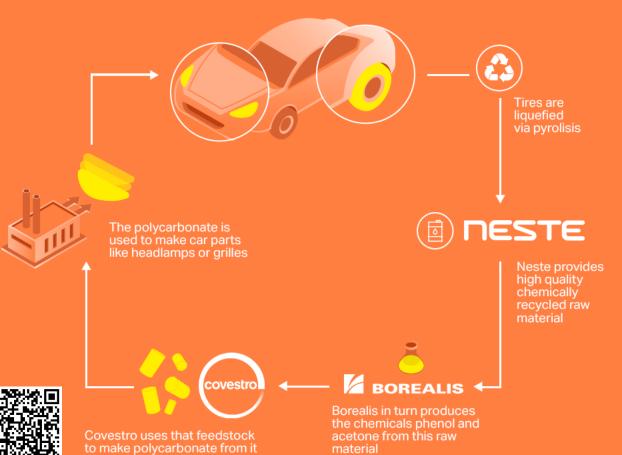




TURNING OLD TIRES INTO NEW CAR PARTS



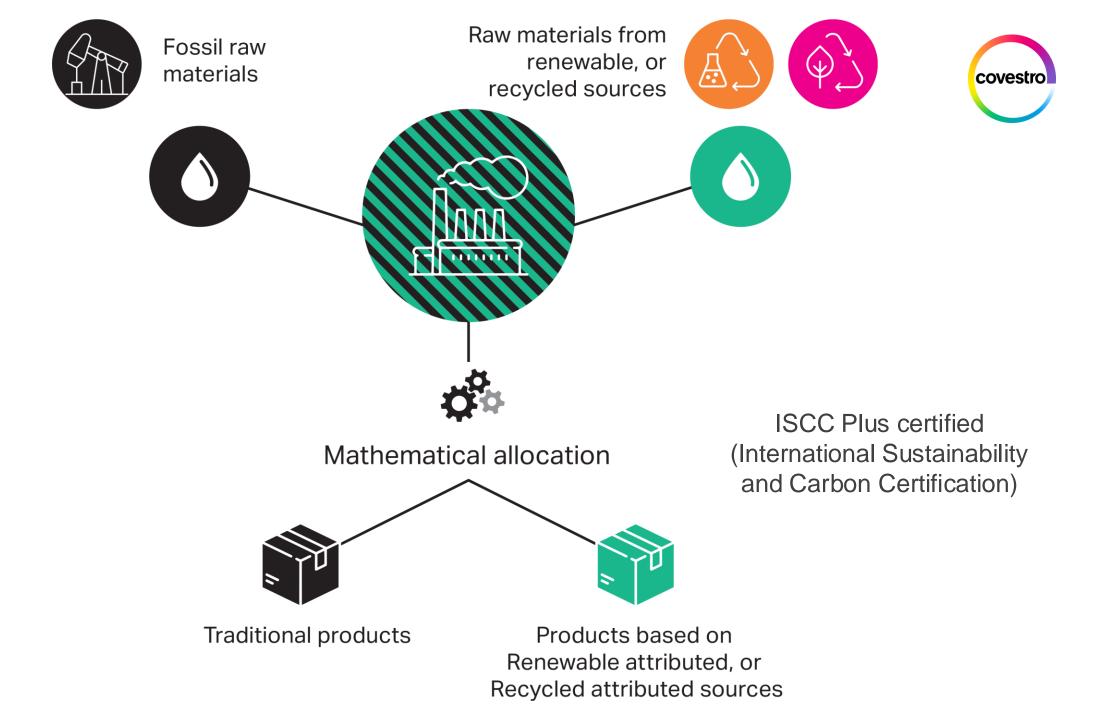
Driving circularity with strong partners











CQ Sustainability Portfolio for Engineering Plastics

Various polycarbonate-based material solutions with improved sustainability





R Series
Mechanically
recycled



Post consumer recycled (PCR) content
UL ECV, TÜV certified
Reduce plastic waste and carbon footprint

RE Series
Renewable
attributed



Bio-circular sources replace fossil resources ISCC Plus* certified Reduce carbon footprint Identical performance as fossil-based material RP Series
Recycled
attributed



Chemically recycled post consumer sources via mass balance ISCC Plus* certified

High purity, chemical recycled Identical performance as fossil- based materials

*ISCC Plus certified (International Sustainability and Carbon Certification)



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