Our purpose:

We create chemistry for a sustainable future
What we want to achieve

- We want to be a thought and action leader in the area of sustainability.
- We want to increase the role of sustainability in our business decisions.
- We want to show how we add value to society along the value chain.

Key measures

- Decouple our CO₂ emissions from organic growth through a Carbon Management program.
- Invest in cutting-edge technologies to speed up the transition to a circular economy, such as our ChemCycling project.
- Further increase our sales from Accelerator products, which make a substantial sustainability contribution in the value chain.
Circular Economy transforms value chains ...

- Public awareness strongly increasing
- Legislation becoming more concrete
- OEMs are setting their own targets
- Recycled replaces virgin materials

How can we contribute?
What does it mean for technology and business?
How to reach recycled plastics in all cars?
How is the value chain changing?

... and is fueled by more stringent regulatory changes
Circular Economy means Decoupling growth from resource consumption

- Keep resources in use for as long as possible
- Minimize residual waste
- Recover and regenerate products and materials
To decouple growth from resource consumption, we need more “close the loops” solutions

<table>
<thead>
<tr>
<th>External factors driving the shift towards circularity</th>
<th>Our contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology shifts</strong></td>
<td><strong>KEEP IT SMART</strong></td>
</tr>
<tr>
<td>e.g. precision farming, electric vehicles</td>
<td>Increase efficiency of processes, enhance effectiveness of products and solutions</td>
</tr>
<tr>
<td><strong>Consumption changes</strong></td>
<td><strong>CLOSE THE LOOP</strong></td>
</tr>
<tr>
<td>e.g. sharing of cars, household goods</td>
<td>Turn waste into resources, use natural loops</td>
</tr>
<tr>
<td><strong>New regulations</strong></td>
<td></td>
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<tr>
<td>e.g. EU Circular Economy package, building insulation standards</td>
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</table>
Keep it smart
Increase efficiency of processes and enhance effectiveness of products and solutions

Resources → Raw material production → Verbund: the efficient use of by-products → BASF production → Customer production → Chemicals enabling resource savings → End-of-life → Biodegradable products

Residual as raw material e.g. visbreaker tar

Chemicals prolonging life span → Use
Close the loops
Turn waste into resources, use natural loops
We have identified three main opportunity fields for CE

1. Enable circularity or improve recycling yields
2. Turn waste into compounds / formulations (mechanical recycling)
3. Turn waste into chemicals (chemical recycling)
A chemical recycling approach: ChemCycling™
Chemical Recycling
A missing link to close the loop

Recycling – close the loop

Chemical recycling
- can handle mixed plastic waste
- produces virgin-grade high-performance materials

Mechanical recycling

Recovery – utilize the energy

Waste to fuel
Incineration

Linear economy

Landfill
Littering
BASF’s ChemCycling™ project
Breaking new ground in plastics waste recycling

Consumers use and dispose of plastic products (e.g. packaging, tyres)

Waste companies collect and sort the waste and supply BASF’s technology partners with it

Our partners convert the plastic waste into pyrolysis oil through a thermochemical process

BASF can allocate the recycled feedstock to all chemicals produced in this Verbund via a certified mass balance approach.

Pyrolysis oil is purified to be used as feedstock at the beginning of BASF’s Verbund production

Our customers use these chemicals to make their own products

BASF’s ChemCycling™ project
Benefits of the ChemCycling™ project
Contributing to a circular economy and saving resources and emissions

- **Plastic waste** for which no high-value recycling processes are established yet *is turned into virgin-grade high performance materials*

- Using recycling feedstock from plastic waste in chemical production helps to *save fossil resources*

- **CO₂ emissions are saved** against conventional plastic production and incineration of plastic waste

Our customers can achieve their recycling targets by using Ccycled™ materials – materials based on chemically recycled plastic waste
With ChemCycling™ more plastic waste will be recycled

- We contribute to the recycling of **plastic waste for which no high value recycling processes are established yet**.
- ChemCycling™ is not a competition but a complementation to mechanical recycling.

- Examples of waste plastics which are difficult to recycle mechanically or which are incinerated include:
  - Plastics with adhering food residues
  - Multi-layer food packaging
  - Scrap tyres and composite plastics used in the automotive and construction industries
With ChemCycling™ we increase recycled content in efficient materials for demanding applications

- Products based on chemically recycled plastic waste do achieve the same level of quality and purity as virgin plastics, because the polymer chains of the plastics are chemically broken down into chemical feedstock.

- This makes it possible to manufacture products with recycled content that have to meet high quality and hygiene standards, for example food packaging.

ChemCycling™ therefore offers opportunities for innovative business models for customers, who place great value on products and packaging made from recycled materials but who cannot or do not want to compromise on quality.
Allocation of recycled feedstock with the mass balance approach
How it works

<table>
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<tr>
<th>Feedstock</th>
<th>BASF Production Verbund</th>
<th>Products</th>
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<tr>
<td>Fossil</td>
<td></td>
<td>Conventional product</td>
</tr>
<tr>
<td>Recycled</td>
<td></td>
<td>Mass balance product</td>
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</table>

Use of recycled feedstock in very first steps of chemical production (e.g., steam cracker)  
Utilization of existing Production Verbund for all production steps  
Allocation of recycled feedstock to selected products
Status of BASF’s ChemCycling™ project
(January 2020)

Project start

Network and partnerships along the value chain developed

2018
- First batches of pyrolysis oil fed into the Verbund
- Certification system for recycled products developed together with ecocycle

2019
- First certified ChemCycling™ product prototypes realized with customers
- Presentation of customer prototypes at K press conference and K fair
- Investment into Quantafuel to jointly drive chemical recycling of mixed plastic waste

2020
- First commercial applications of high-performance plastics from recycled feedstock in demanding applications
The Biomass Balance approach
The Biomass Balance Approach: Replacing fossil resources in the current Production Verbund

**Feedstock**
- Fossil
- Renewable

**BASF Production Verbund**
- Use of renewable feedstock in very first steps of chemical production (e.g., steam cracker)
- Utilization of existing Production Verbund for all production steps

**Products**
- Conventional product
- Biomass Balance product

Allocation of renewable feedstock to selected products
Biomass Balance Approach can be compared to green electricity.
Renewable raw materials need to be sourced sustainably

Use certified renewable raw materials

- Waste/residues are preferred renewable raw materials
- Independent sustainability certification from recognized schemes, e.g., REDcert-EU and ISCC-EU

Apply standardized sustainability criteria

- Minimum sustainability criteria as in EU RED*
- Greenhouse gas emissions savings
- Responsible biomass production
- Protection of areas with high biodiversity and large carbon stocks

* Renewable Energy Directive of EU Commission
Industries already benefit from our Biomass Balance products

HySorb® Biomass Balanced – Sustainable superabsorber for baby diapers

Ultramid® polyamide for textile application

Flexible films for new packaging made of Ultramid®

Styropor packaging solution

R-M® automotive refinish products

Decorative effect paints with Acronal®

Acronal® binders for interior paints

EU-REDcert-Methanol

Glasurit® automotive refinish products
Circular Economy
Solution Examples
Accelerator
HySorb® Biomass Balanced

Process information

| Application: | Superabsorbent polymers for disposable diapers, feminine hygiene and incontinence products |
| Customer Industry: | Hygiene Industry |
| Market: | Global |

Sustainability performance

- BASF’s biomass balance approach drives the replacement of fossil with renewable resources in the value chain of this or other BASF products.
- Renewable feedstock with sustainability certificate is used at the beginning of the production chain and then allocated to this biomass balanced product*, based on third-party standard by REDcert².
- LCA results (3rd party reviewed BASF assessment): saves fossil resources and reduces carbon footprint compared to non biomass balanced HySorb®.

→ High performance superabsorbent driving the use of biomass

Differentiation potential

- Renewable feedstock
- Climate change
- Additional resource efficiency through preferred use of waste vegetable oil & fat, organic waste biogas
- Added value proposition, for consideration by customers in developing their claims
Accelerator
Cetiol® Ultimate

Process information

Application: Ultra-fast spreading emollient for face, body, sun care and color cosmetics

Customer Industry: Personal care

Market: Global

Sustainability performance

- 100 percent renewable-based and volatile emollient
- Replacement of volatile silicones possible
- Easier to use than volatile hydrocarbons
- Readily biodegradable
- Gives more flexibility in the development of natural cosmetic concepts for improved skin feel

Differentiation potential

Customer:
- Plant based chemistry for possible cyclomethicone substitution
- New formulation textures and claims possible

Consumer:
- New natural cosmetic concepts

→ Regarded as break through innovation and was awarded with market prizes
Accelerator
ecovio® M2351 (mulch film)

Process information

- **Application:** Mulch film
- **Customer Industry:** Agriculture
- **Market:** Global

Sustainability performance

- Biodegradability in soil leaving no residues in the field after ~2 years, unlike traditional polyethylene films
- Resource efficiency and water savings over time (higher yields by avoiding the white pollution of PE residues)
- Avoiding emissions of toxic substances from open burning of PE mulch film
- Waste reduction, avoiding soil displacement by PE residues

Differentiation potential

- Cost Savings Downstream
- Pollution (air, soil)
- Resource Efficiency
- Climate Change & Energy
- Biodiversity

→ Over time, ecovio® biodegradable mulch film helps to avoid adverse consequences of the white pollution in agriculture such as crop yield decrease and water savings
Sustainability performance

- Repairs of minor to moderate damages to car parts are now among body shops' most common repair jobs. They have to work profitably in this segment.
- UV-A technology ensures quicker drying than any other heat source, commonly used in body shops. It therefore enables them to save energy costs and drying time.
- Saves further process times because it eliminates the cooling phase.
- UV-A radiation is the least harmful part of ultraviolet light. This makes the technology safe and easy to use.
- Biomass balanced product: 100 percent of fossil resources are mathematically replaced by renewable resources, the method is certified by REDcert².

→ Boost efficiency at the speed of light

Process information

**Application:** Rapidly drying primer filler, ideally suited for minor and moderate repair jobs

**Customer Industry:** Automotive refinishing coatings

**Market:** EMEA

Differentiation potential

Customer:

- Cost savings downstream
- Resource efficiency
- Climate change and energy
Accelerator
cavipor® FTX 1

Process information

Application: Thermal insulation
Customer Industry: Construction
Market: Europe

Sustainability performance
- Ecological – natural and upcycled raw material
- CO₂ – efficient – low energy consuming production
- Non combustible – mineral based
- Non hazardous – foamed with water and air
- Recyclable – re-use of old material

Differentiation potential
- Homogeneous insulation
- Transport and store 1/10 of foam volume
- Safe, fast and clean application
- Breathable
- Easily disposable

→ Reliable insulation
We create chemistry