The Bornewables™ – a sustainable alternative to virgin polyolefins

Borealis' portfolio of circular polyolefins reduces carbon footprint while offering equally high material performance

EverMinds™
Accelerating Action on Circularity

BOREALIS

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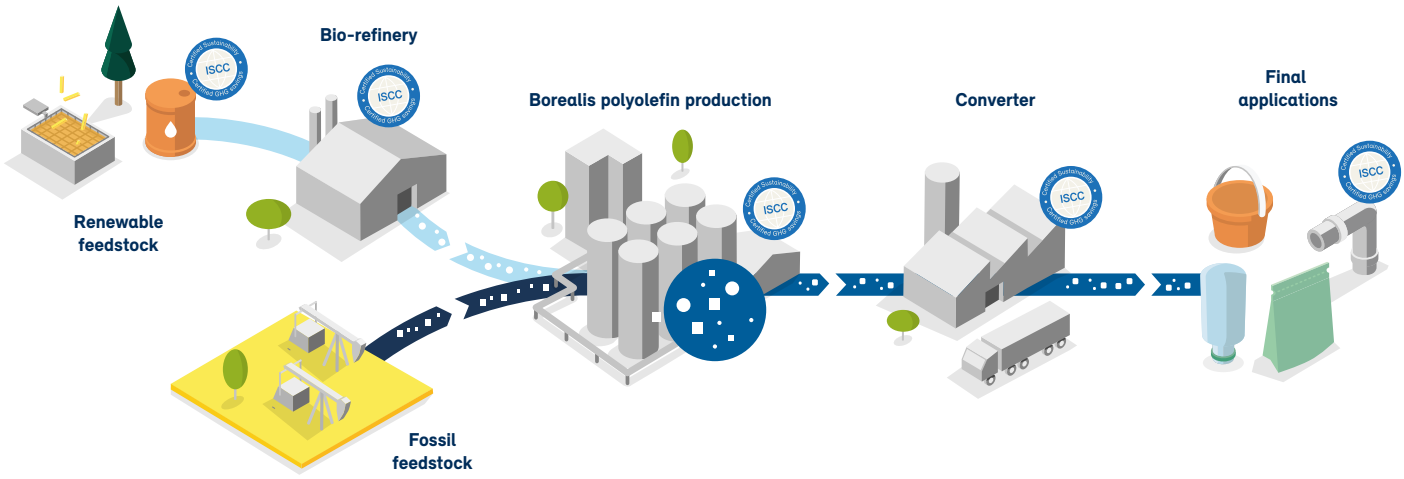
The Bornewables™ are ISCC PLUS certified polyolefins with reduced carbon footprint, enabling our customers to meet their sustainability targets while maintaining existing quality standards

Bornewables products are made using sustainably sourced renewable feedstocks derived solely from waste and residue vegetable oils, such as used cooking oil and residues from vegetable oil processing. The residue from vegetable oil processing consists of rancid fat that has to be removed to produce food-grade oil. The used cooking oil, entirely waste and residues in origin, is a waste stream collected from restaurants and the food industry. These waste and residues are still good raw materials to be processed into our feedstock, helping to reduce waste and wastewater pollution, for example. These waste and residues are traceable back to their point of origin, following the ISCC* PLUS chain of custody.

The waste and residue raw materials that are used to produce our feedstock are no longer fit for human consumption, and as such, do not impact food security. While also reducing waste and wastewater pollution, their use helps reduce the carbon footprint to the end-product compared to conventional plastics and contributes to the circular economy by helping to decouple plastics from the use of fossil feedstocks.



The Bornewables™ are based on the mass balance approach

- All Bornewables polyolefins are ISCC PLUS certified
- Raw materials used to produce the renewable feedstock for the Bornewables are traceable to their point of origin
- In the production of the Bornewables, the mass balance approach is used to save an identical volume of fossil feedstock by replacing it with sustainable feedstock
- By choosing the Bornewables, you contribute to the sustainable sourcing of renewable materials from carefully selected suppliers committed to sustainability.

*International Sustainability & Carbon Certification

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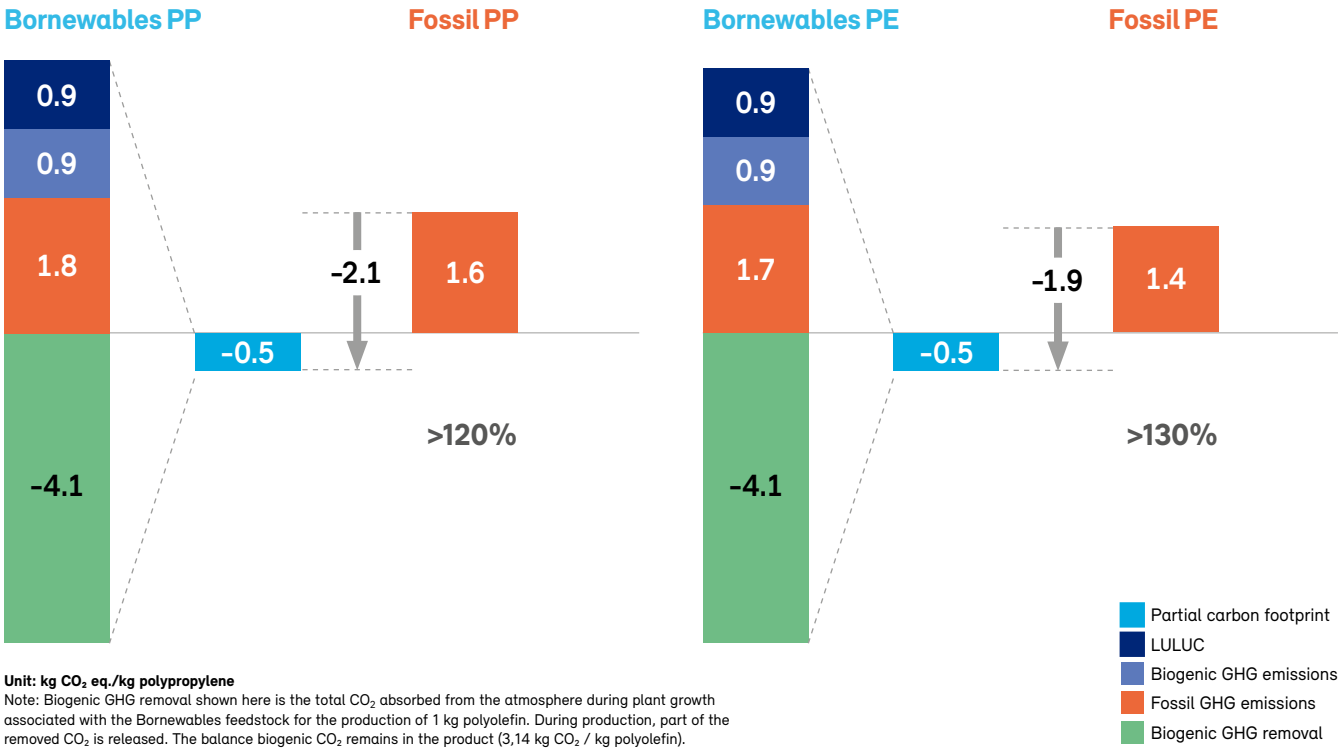
The Bornewables™ are proven to reduce greenhouse gas emissions

A cradle-to-gate Life Cycle Assessment (LCA) study, conducted according to ISO14040:2006 and ISO14044:2006, has shown that the Bornewables contribute towards the mitigation of climate change by providing significantly lower greenhouse gas emissions compared to polyolefins made from fossil-based feedstock. The LCA was performed to understand the potential environmental impacts of Bornewables polypropylene (PP) and polyethylene (PE) produced at Borealis' sites in Sweden, Finland and Belgium from both steam cracker and propane dehydrogenation routes, compared to polyolefins produced from equivalent fossil feedstocks at these sites. Comparing the Bornewables polypropylene to conventional fossil-based polypropylene produced at the sites investigated, the LCA revealed that the partial carbon footprint could be reduced from 1,6 kg* to -0,5 kg CO_2eq. / kg PP (3,14 kg biogenic** CO_2 in stored in 1 kg PP) - a reduction of at least 120%. For Bornewables polyethylene compared to polyethylene manufactured with fossil-based feedstock via Borealis' processes, the partial carbon footprint (cradle-to-gate) is reduced by at least 1.9 kgCO_2eq/kg polymer, from 1.4 kg* to -0.5 kgCO_2eq/kg. (3.14 kg biogenic CO_2 stored in 1kg PE polymer) – a reduction of more than 130%. Furthermore, the Bornewables are a lower-emissions alternative to fossil-based PP or PE no matter which end-of-life option is chosen. Even in the case of energy recovery, when the carbon contained in the product is released during incineration, the carbon footprint reduction still amounts to more than 40% compared to both PP and PE from the equivalent fossil-based feedstock. The analysis also revealed that in the production of the Bornewables, sustainably sourced renewable feedstock reduces fossil resource depletion by at least 73%.

The study also showed that the upstream burdens from cultivation and processing the waste and residue streams into the raw materials of our feedstock, cause higher impacts in acidification and eutrophication compared to polyolefins made from equivalent fossil-based feedstock. The impact category photochemical ozone creation potential are in the same order of magnitude as with the fossil counterparts.



Unit: kg CO_2 eq./kg polypropylene
Note: Biogenic GHG removal shown here is the total CO_2 absorbed from the atmosphere during plant growth associated with the Bornewables feedstock for the production of 1 kg polyolefin. During production, part of the removed CO_2 is released. The balance biogenic CO_2 remains in the product (3,14 kg CO_2 / kg polyolefin).

Impact category	Bornewables PP	Fossil PP	Bornewables PE	Fossil PE
GWP (kg CO_2 eq. / kg polyolefin)	-0.5	1.6	-0.5	1.4
Abiotic resource depletion, fossil MJ / kg polyolefin	18	70	15	67

*Borealis is separately undertaking an LCA for it's fossil-based polyolefins at production site level in Europe, resulting in potential changes of carbon footprint
**based on mass-balance

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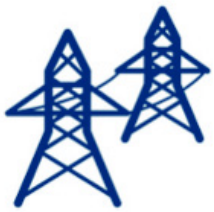
When replacing one tonne of conventional PP with Bornewables,™ at least 2.1 tonnes CO_2 eq. could be saved

This is comparable to the greenhouse gas emissions of:



95% of average European household's annual energy usage[1]

20 meat-lovers going vegetarian for a month[2]

charging **2,100** smartphones for a year[3]

1. Electricity, Gas etc (2019, EU-27) per person: 726 kg/jr, 3.1 p./h.h
2. meat-lover = 7.2 kgCO_2/day; vegetarian = 3.8 kgCO_2/day
3. Charging for 2hrs at 6W in EU (2018) at ~230grCO_2/kWh

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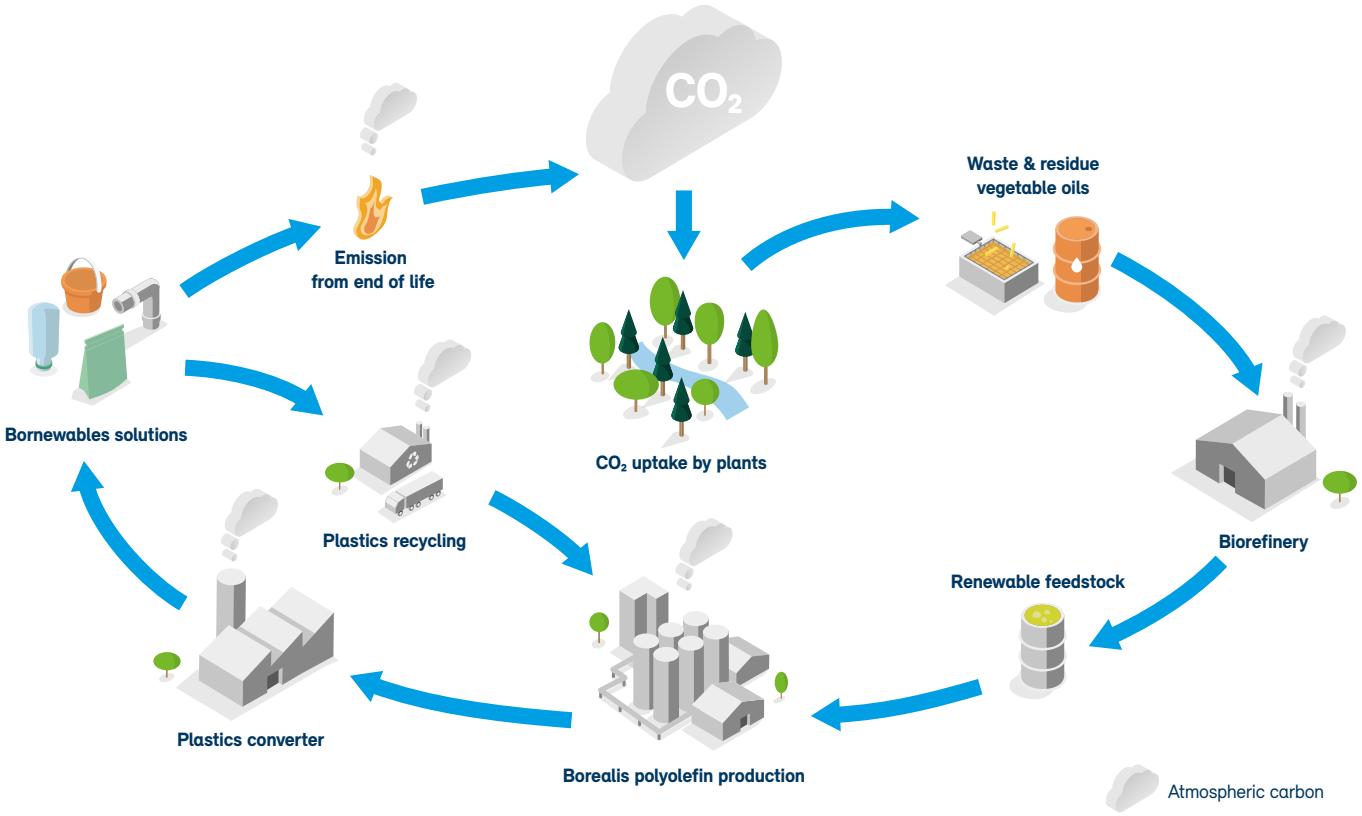
The Bornewables™ feedstock contains carbon absorbed from the atmosphere during the plant's growth phase, thereby reducing the carbon footprint



During the growth phase of the plant it absorbs CO_2 from the atmosphere and stores it in the biomass of the plant.

The CO_2 removed from the atmosphere is reflected as an emissions saving in the LCA calculation.

This biomass is then used to produce the feedstock for the production of our plastics.

When recycling or reusing the plastic, carbon will be kept in the loop instead of being released into the atmosphere at the End of Life (EoL).

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Accelerating the transition to a circular economy

The Bornewables™ produced by replacing fossil-based feedstock with an identical volume of sustainably sourced renewable feedstock, help our customers decouple from fossil resources.

And by offering the same portfolio, customers avoid switching costs and benefit from the same product quality and safety needed by most demanding applications, such as food packaging, automotive and healthcare.

In line with Borealis' EverMinds™ platform, which seeks to promote circularity through innovation, the Bornewables offer brand owners and converters the opportunity to:

Be a part of the circular revolution for plastic. Be a part of EverMinds™.

A platform aiming to unlock and accelerate circular progress for plastic. We are building a community to bring stakeholders, influencers and circular game-changers together. Uncompromising on quality and performance. Let's create new value that keeps giving back and create circular progress as one.

Show their own customers that they care about sustainability and help contribute to a better future.

Contribute to the sourcing of renewable raw materials from carefully selected suppliers who are committed to sustainability.

Manufacture fully recyclable packaging solutions with a lower carbon footprint to help meet their sustainability targets without compromising of performance.

Trace renewable raw materials to their point of origin, and ensure their sustainability, thanks to ISCC PLUS mass balance certification.

To find out how the Bornewables™ can help reduce your carbon footprint, please visit **borealisgroup.com/bornewables**

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Borealis is one of the world's leading providers of advanced and circular polyolefin solutions and a European market leader in base chemicals, fertilizers and the mechanical recycling of plastics. We leverage our polymers expertise and decades of experience to offer value adding, innovative and circular material solutions for key industries. In re-inventing for more sustainable living, we build on our commitment to safety, our people and excellence as we accelerate the transformation to a circular economy and expand our geographical footprint.

With head offices in Vienna, Austria, Borealis employs 6,900 employees and operates in over 120 countries. In 2021, Borealis generated total sales and other income of EUR 10,153 million and a net profit of EUR 1,396 million. OMV, the Austria-based international oil and gas company, owns 75% of Borealis, while the remaining 25% is owned by a holding company of the Abu-Dhabi based Mubadala. We supply services and products to customers around the globe through Borealis and two important joint ventures: Borouge (with the Abu Dhabi National Oil Company, or ADNOC, based in UAE); and Baystar™ (with TotalEnergies, based in the US).

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Cover photos courtesy of BE O Lifestyle

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