

The Bornewables™

A sustainable alternative to virgin polyolefins

Borouge International's portfolio of circular polyolefins provides sustainable alternatives to fossil-based materials while maintaining high material performance



The Borneables™

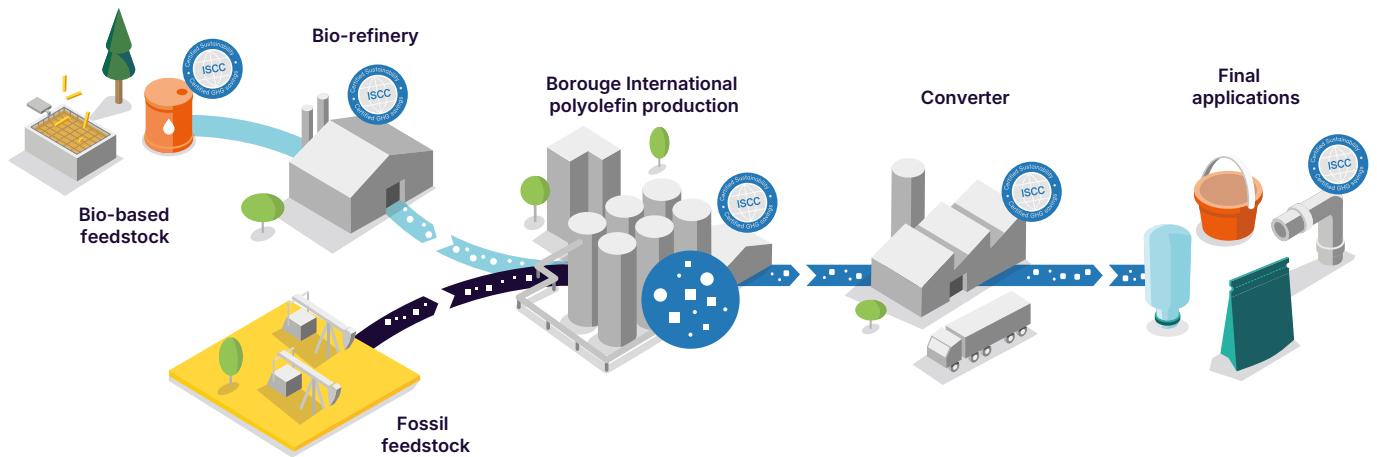
are ISCC PLUS certified polyolefins with reduced carbon footprint, enabling our customers to meet their sustainability targets while maintaining existing quality standards

Borneables™ products are made using sustainably sourced bio-based 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 still good raw materials to be processed into our feedstock and 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 not fit for human consumption, and as such, do not impact food security. While also reducing waste and wastewater pollution, using those helps to reduce the carbon footprint of 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 Borneables™ are based on the mass balance approach

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

The Bornewables™

are proven to reduce greenhouse gas emissions

A cradle to gate Life Cycle Assessment (LCA) study, conducted according to ISO14040 and ISO14044, has shown that the Bornewables™ contribute towards the mitigation of climate change by providing significantly lower greenhouse gas emissions compared to traditional polyolefins made from fossil-based feedstock.

The LCA has been performed to understand the potential environmental impacts of Bornewables™ polypropylene (PP) and polyethylene (PE) produced at Borouge International's sites in Sweden, Finland and Belgium from both steam cracker and propane dehydrogenation routes, compared to polyolefins produced from fossil feedstocks at these sites.

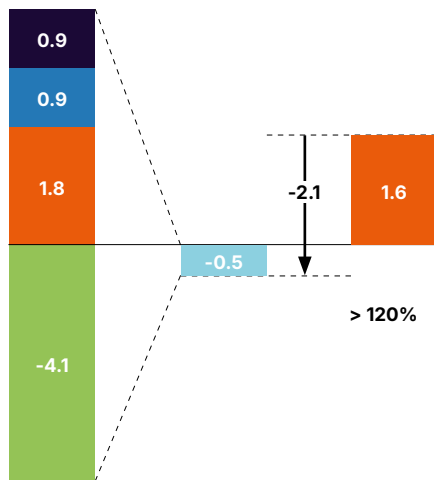
Comparing the Bornewables™ polypropylene to conventional fossil-based polypropylene produced at the sites investigated, the LCA revealed that the partial carbon footprint could be reduced from 1.6 kg to -0.5 kg CO₂ eq/kg PP (3.14 kg biogenic CO₂ is stored in 1 kg PP) – a reduction of at least 2.1 kg CO₂ eq. For Bornewables™ polyethylene compared to polyethylene manufactured with fossil-based feedstock via

Borouge International's processes, the partial carbon footprint (cradle-to-gate) is reduced by at least 1.9 kg CO₂ eq/kg polymer, from 1.4 to -0.5 kg CO₂ eq/kg. (3.14 kg biogenic CO₂ stored in 1 kg PE polymer). 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 stored in the product is released during incineration, the carbon footprint reduction still amounts to 44% compared to PP from fossilbased feedstock and 42% compared to PE from fossil-based feedstock. The analysis also revealed that in the production of the Bornewables™, sustainably sourced bio-based 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 fossil-based feedstock. The environmental impacts on photochemical ozone creation potential were shown to be in the same order of magnitude as with the fossil comparator.

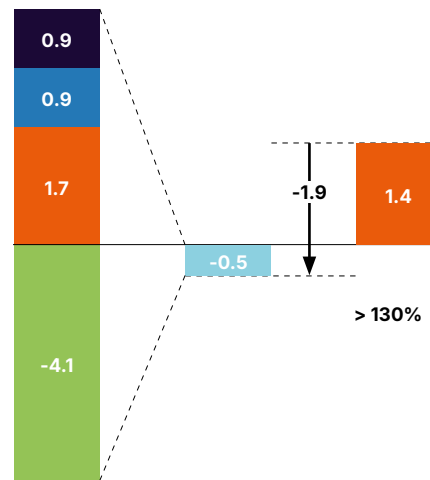
Bornewables™ PP

Fossil PP³



Bornewables™ PE

Fossil PE³



Unit: kg CO₂ eq/kg polypropylene

Note: Biogenic GHG removal shown here is the total CO₂ 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 CO₂ is released. The balance biogenic CO₂ remains in the product (3,14 kg CO₂ / kg polyolefin).

- Partial carbon footprint
- LULUC
- Biogenic GHG emissions
- Fossil GHG emissions
- Biogenic GHG removal

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

1 Borouge International has separately undertaken life cycle analysis of its fossil-based polyolefin portfolio reflecting latest oil and gas upstream LCI data.

2 Based on mass-balance.

3 Based on Ecoinvent 3.6 database. Later database updates to oil and gas supply result in higher carbon footprint for fossil-based PO.

When replacing one tonne of conventional PP with Borneables™, at least 2.1 tonnes CO₂ eq could be saved

This is comparable to the greenhouse gas emissions of:



95% of average European household's annual energy usage¹



20 meat-lovers going vegetarian for a month²



charging 2,100 smartphones for a year³

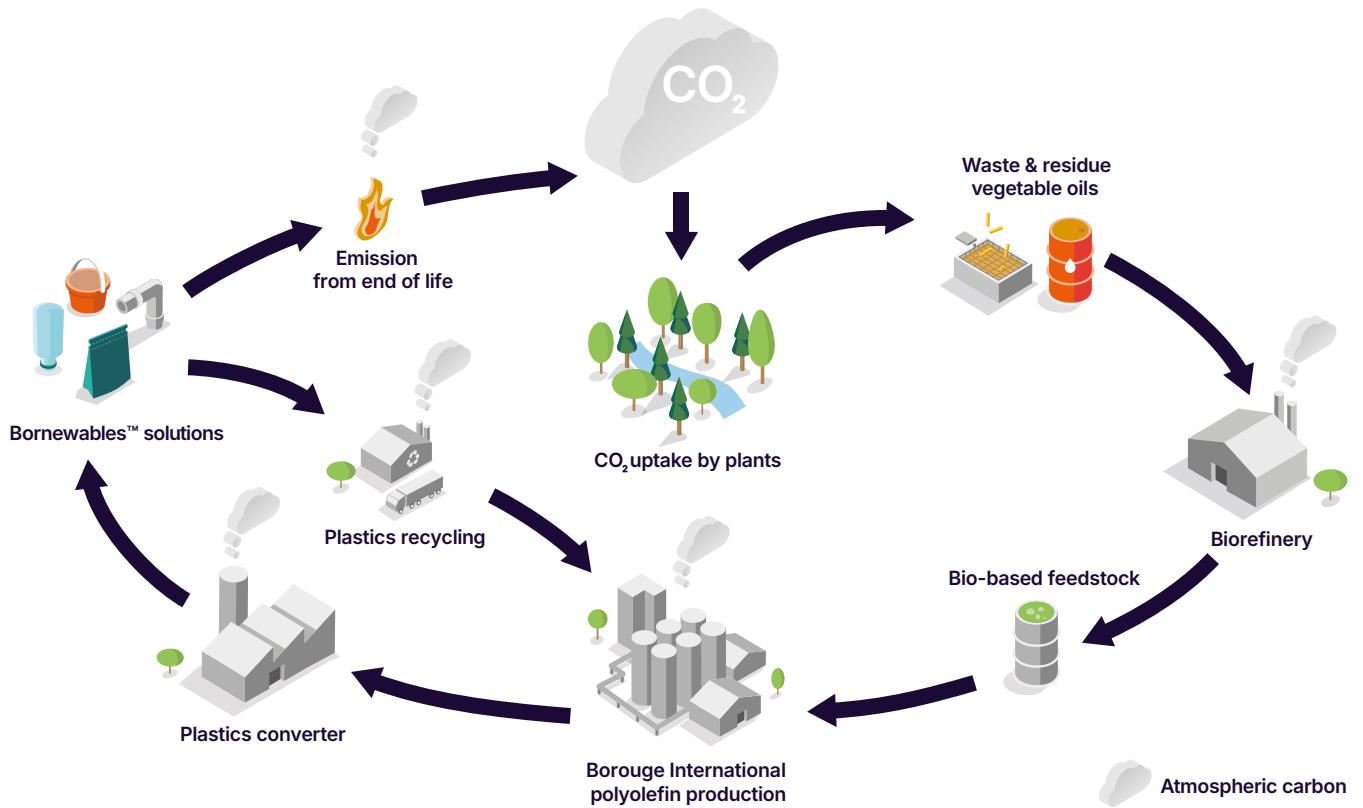
¹ Electricity, Gas etc (2019, EU-27) per person: 726 kg/Jr, 3.1 p./h.h


² meat-lover = 7.2 kg CO₂/day; vegetarian = 3.8 kg CO₂/day


³ Charging for 2 hrs at 6 W in EU (2018) at ~230 gr CO₂/kWh


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

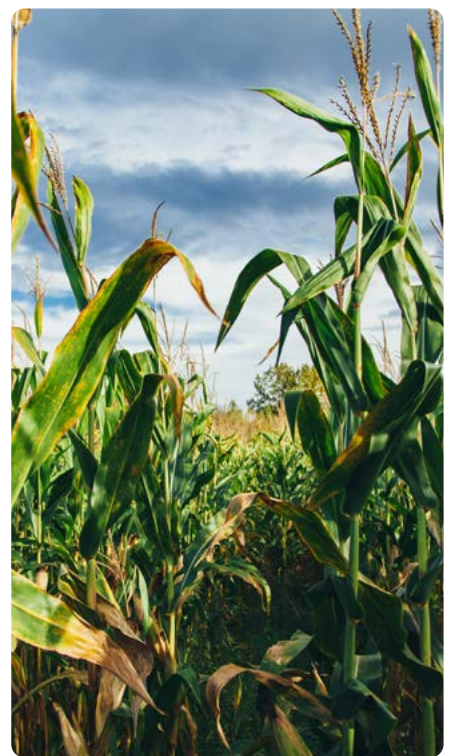



 During the growth phase, the plant absorbs CO₂ from the atmosphere and stores it in the biomass of the plant.


 The CO₂ 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).

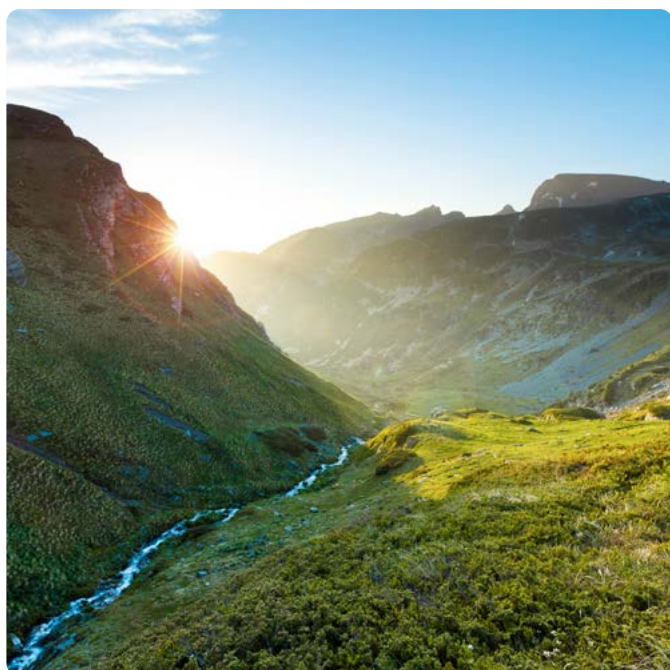


Accelerating the transition to a circular economy

The Bornewables™, produced by replacing fossil-based feedstock with an identical volume of sustainably sourced bio-based 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 the most demanding applications, such as food packaging, automotive and healthcare.

With the global reach of Borouge International, we deliver circular material solutions reliably and efficiently to customers across key markets worldwide. Supported by ISCC PLUS certifications, we provide trusted standards of traceability, consistency and quality throughout our international network. This enables customers across all Borouge International regions to access sustainable solutions with reliable supply, expertise and support wherever they operate.



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



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



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



Manufacture fully recyclable packaging solutions with a lower carbon footprint, but equally high performance, helping to meet their sustainability targets.



To find out how the Bornewables™ can help reduce our carbon footprint, please visit

borealisgroup.com/bornewables

About Borouge International

Borouge Group International AG (Borouge International) is a global leader in polyolefins formed in 2026 through the combination of Borouge Plc, Borealis and NOVA Chemicals. Backed by long-term shareholders XRG, the international investment arm of ADNOC, and OMV, Borouge International brings together world-class assets, advantaged feedstock access and proprietary technology to deliver reliable high-performance polyolefin solutions across consumer products, infrastructure, energy, mobility and advanced products.

Borouge International combines a differentiated asset base, global reach and deep technical expertise to serve customers across key growth markets. The company is headquartered in Austria, with a regional headquarters in Abu Dhabi and corporate hubs in North America and Asia Pacific.

Learn more about the company: borougeinternational.com.

Borouge International

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