BASF
We create chemistry

The Biomass Balance Approach

Products from renewable raw materials

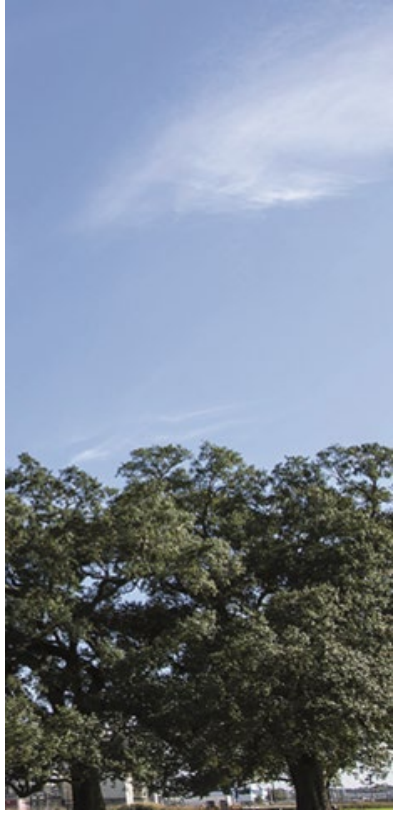
Ludwigshafen, February 2021

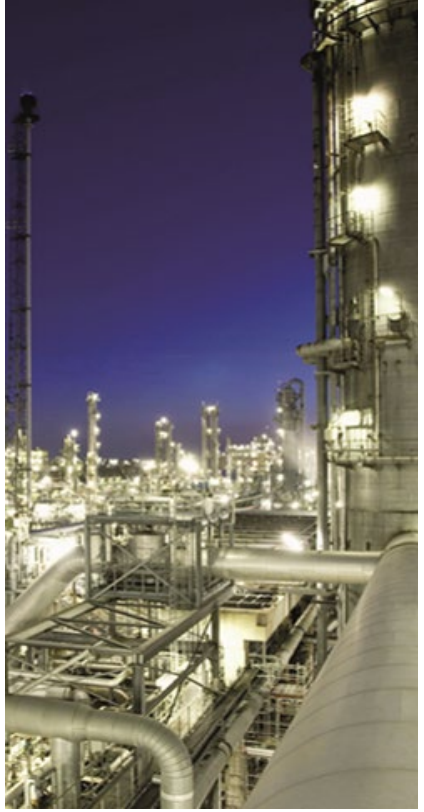
We are heading towards a sustainable future

In the 21st century, sustainability has become a worldwide megatrend

Modern life is great. But it is also taking a heavy toll on our planet. If we want to keep nature intact, we need to be more efficient with our resources.

That is why the concept of sustainability has become a megatrend – in politics as well as in business sectors as diverse as the chemical industry.





Inte

More and more customers are making environmentally conscious purchasing decisions

- Purchasing decisions are based on values
- Price and quality remain important
- Transparency is key: customer prefer brands that they perceive as authentic and trustworthy
- Consumers are critical and question producers' promises

Inte

BASF
We create chemistry

BASF‘s Biomass Balance Approach

- Requires no reformulation – identical product performance
- Available easy and fast for nearly all our products
- Saves fossil resources and reduces greenhouse gas emissions
- Drives the use of sustainable renewable feedstock

Inte

The Biomass Balance Approach: Replacing fossil resources in the current Production Verbund

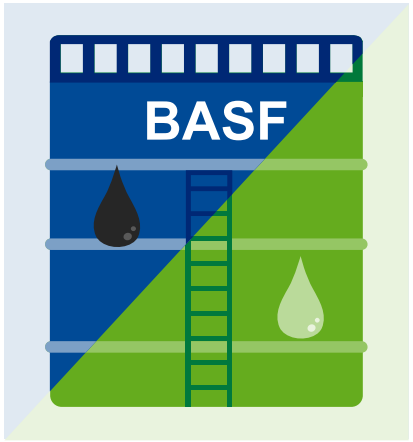
Feedstock

Fossil

Renewable

Use of renewable feed-stock in very first steps of chemical production (e.g., steam cracker)

BASF Production Verbund



Utilization of existing Production Verbund for all production steps

Products

Conventional product

Biomass Balance product

Allocation of renewable feedstock to selected products

Renewable raw materials need to be sourced sustainably

Use certified renewable raw materials

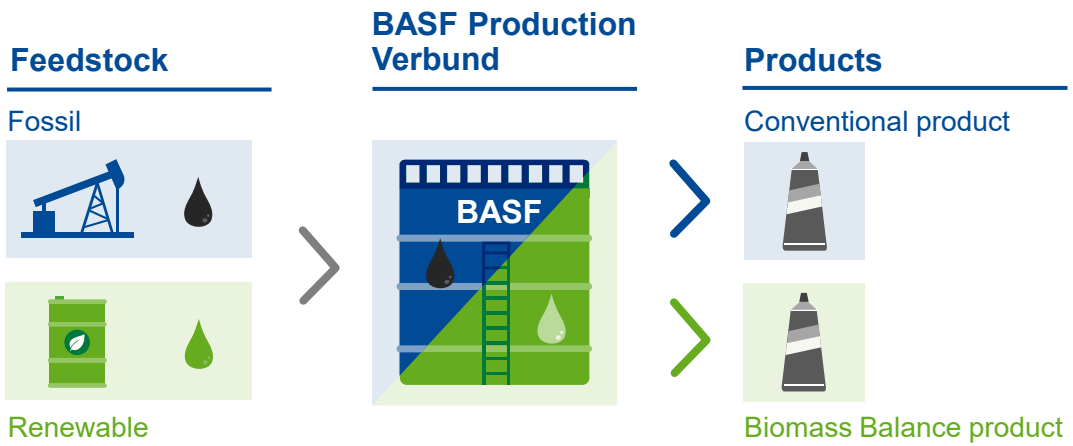
- Waste/residues are preferred renewable raw materials
- Independent sustainability certification from recognized schemes, e.g., REDcert-EU and ISCC-EU

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

Biomass is used as feedstock at the very beginning of the integrated production system



Therefore,…

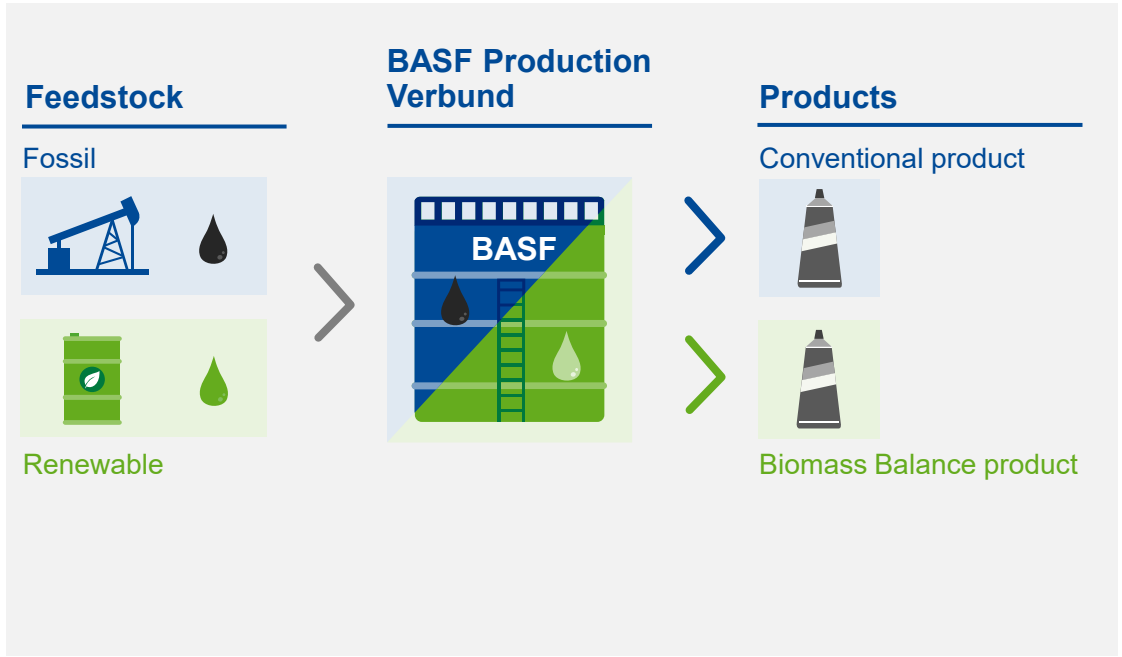
… it can be applied to the majority of the products in its portfolio.

… we can use our highly efficient Production Verbund

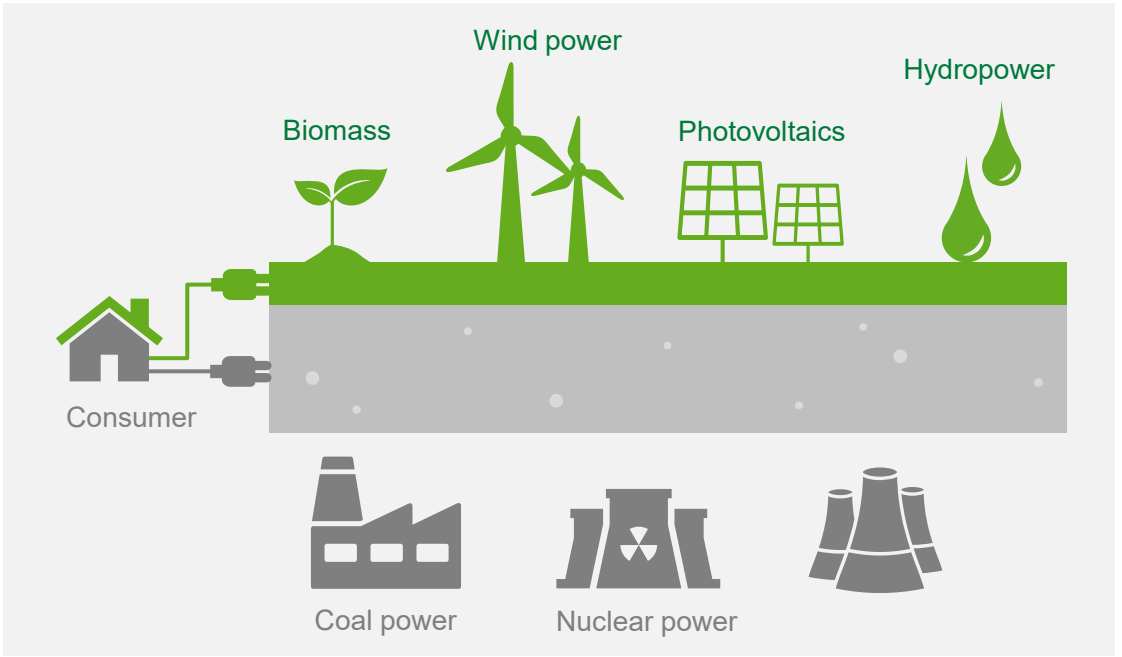
… Product performance stays identical to conventional products

Biomass Balance Approach can be compared to green electricity

Biomass Balance Approach



Green electricity



The Biomass Balance Approach –

how recources become part of our integrated production system

- **~10 km²** site area
- **~200** production plants
- **~ 2,850 km** pipeline system
- **~ 8.5 million** metric tons sales products p.a.*
- **~ 3.4 million** t CO_2 savings via Verbund p.a.**

* As of December 31, 2018

** Comparison: conventional power and steam generation in separate plants based on natural gas

Challenge: Renewable materials cannot be directed to one specific product

Feedstock

Fossil

Renewable

BASF Production Verbund

Therefore,
an external certification
system is needed

Products

Conventional

Allocated

Our solution: Certification and standardization

Feedstock

Fossil

Renewable

BASF Production Verbund

REDcert²

Products

Conventional

Allocated

The new REDcert² standard ensures the correct allocation of renewable resources in BASF's value chain.

Certificates for high credibility

“Fossil resource saving product. X% of the fossil feedstock required for the manufacturing of this product was replaced in the production site by renewable raw materials.“

Certified by certification body according to REDcert² scheme

“The replacement of fossil through renewable feedstock reduces the greenhouse gas emissions by x t CO_2 equivalents per t product.”

Additional self-assessment of BASF for declaration according to ISO 14021

CERTIFICATE

REDcert² -529-35213367

TÜV NORD CERT GmbH

Langemarckstraße 20, 45141 Essen,

Germany

confirms that

BASF SE

64056 Ludwigshafen

Germany

complies with the requirements of the certification system

REDcert²

The inspection report No. 35232554 dated 20.12.2018 documents that the requirements
the REDcert² certification system for the purpose of biomass balanced products is fulfille

The certified system user is a

conversion unit (manufactures of basic chemicals)

This certificate is valid from 21.12.2018 to 20.12.2019.

Essen, 21.12.2018

Place, Date

Stamp, Signature

The Certification Body is responsible for the accuracy of the certificate.

Example multi-site certificate

TÜV NORD CERT GmbH

Langemarckstraße 20, 45141 Essen,

Germany

confirms that the product:

Product name

is handled / produced by the certified site

BASF SE

64056 Ludwigshafen

Germany

complies with the requirements of the certification system

REDcert²

The inspection report No. 35213367 dated 20.12.2018 documents that the requirements of the REDcert² certification system for the purpose of biomass balanced products for the chemical industry is fulfilled and that the following claims comply with the system principles:

☒ Fossil resources saving product
☒ Fossil resource saving product by using renewable raw materials in the value chain
☒ This product supports a 100 % substitution of fossil with renewable raw materials in the value chain

The certified system user is a

conversion unit (e.g. manufactures of basic chemicals)

This certificate is valid from 21.12.2018 to 20.12.2019.

Essen, 21.12.2018

Place, Date

Stamp, Signature

The Certification Body is responsible for the accuracy of the product certificate.

Example product certificate

The National German Sustainability Award 2015: BASF rewarded for resource efficiency

Biomass Balance approach honored as an important cornerstone

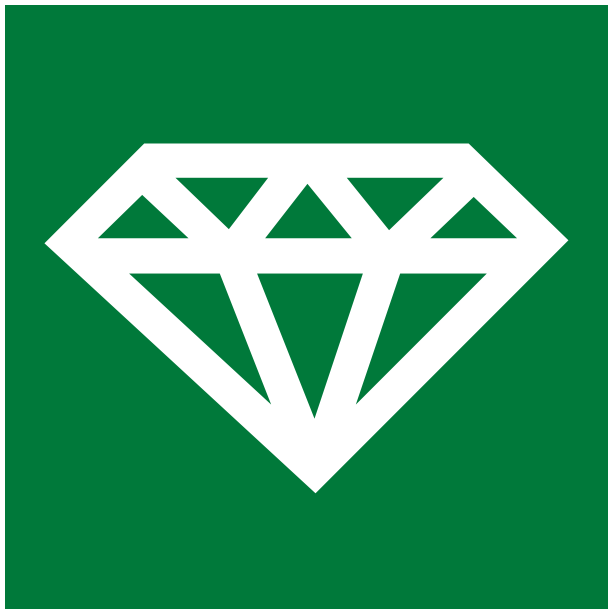
Reasons given by the jury:

- *"…resource and energy efficiency plays a key role in BASF's sustainability strategy…"*
- *"…increasing substitution of fossil resources by renewable raw materials…"*
- *"…BASF has developed the biomass balance approach to integrate renewables in their production…"*
- *"…BASF's interlinked Verbund production enables savings of energy consumption, emissions and waste…"*
- *„…BASF products are helping its costumers to reduce their CO2 emissions…"*

We create chemistry that makes your product love renewable raw materials

100% sustainably sourced renewable feedstock

Saving of fossil resources and reduction of CO_2 footprint



High quality – identical performance

Make your sustainability story complete with Biomass Balanced products

Industries already benefit from our Biomass Balance products

HySorb® Biomass Balanced –
Sustainable superabsorber for baby diapers

R-M® automotive refinish products

EU-REDcert-Methanol

Glasurit® automotive refinish products

Ultramid® polyamide for textile application

Decorative effect paints with Acronal®

Flexible films for new packaging made of Ultramid®

Acronal® binders for interior paints

Styropor packaging solution

BASF
We create chemistry


BASF
We create chemistry
OPPANOL® BMBcert™
Polyisobutene (PIB) derived from
100% renewable feedstock

OPPANOL® BMBcert™ Biomass Balanced

The new OPPANOL® B BMBcert™ products complete BASF's OPPANOL® product family and are **the first Biomass Balanced polyisobutenes derived from 100 % renewable feedstock and deliver measurable CO_2 savings**. The certified products thus contribute to sustainable development by saving fossil resources and reducing greenhouse gas emissions. This unique solution enables customers to differentiate their products from competition and helps towards achieving their sustainability goals. All of that without compromising on performance and quality.

OPPANOL® B 10 SFN BMBcert™
Reduced CO_2 footprint by ~85% or 2.7kg CO_2 eq. per kg of product

OPPANOL® B 10 SFN
Fossil feedstock

Total product carbon footprint
3.2 kg CO_2-eq.

OPPANOL® B 10 SFN BMBcert™
Biogas feedstock

Total product carbon footprint
0.5 kg CO2 eq.

~21,000 kilometres

Producing one ton of OPPANOL® BMBcert instead of OPPANOL® can reduce as much CO_2 as emitted from driving a passenger car for 21,000 km

BASF calculates the product carbon footprint based on the global warming potential for a 100-year evaluation period (GWP100) using characterization factors from the 2013 IPCC Assessment. Report (AR5) including climate carbon cycle feedback. Inventory is based on a cradle-to-gate consideration.

OPPANOL® B 12 SFN BMBcert™
Reduced CO_2 footprint by ~85% or 2.7kg CO_2 eq. per kg of product

OPPANOL® B 12 SFN
Fossil feedstock

Total product carbon footprint
3.2 kg CO_2-eq.

OPPANOL® B 12 SFN BMBcert™
Biogas feedstock

Total product carbon footprint
0.5 kg CO2 eq.

~21,000 kilometres

Producing one ton of OPPANOL® BMBcert instead of OPPANOL® can reduce as much CO_2 as emitted from driving a passenger car for 21,000 km

BASF calculates the product carbon footprint based on the global warming potential for a 100-year evaluation period (GWP100) using characterization factors from the 2013 IPCC Assessment. Report (AR5) including climate carbon cycle feedback. Inventory is based on a cradle-to-gate consideration.

OPPANOL® B 15 SFN BMBcert™
Reduced CO_2 footprint by ~82% or 2.7kg CO_2 eq. per kg of product

OPPANOL® B 15 SFN
Fossil feedstock

Total product carbon footprint
3.3 kg CO_2-eq.

OPPANOL® B 15 SFN BMBcert™
Biogas feedstock

Total product carbon footprint
0.6 kg CO2 eq.

~21,000 kilometres

Producing one ton of OPPANOL® BMBcert instead of OPPANOL® can reduce as much CO_2 as emitted from driving a passenger car for 21,000 km

BASF calculates the product carbon footprint based on the global warming potential for a 100-year evaluation period (GWP100) using characterization factors from the 2013 IPCC Assessment. Report (AR5) including climate carbon cycle feedback. Inventory is based on a cradle-to-gate consideration.

OPPANOL® BMBcert™ Biomass Balanced

100% sustainably sourced renewable feedstock

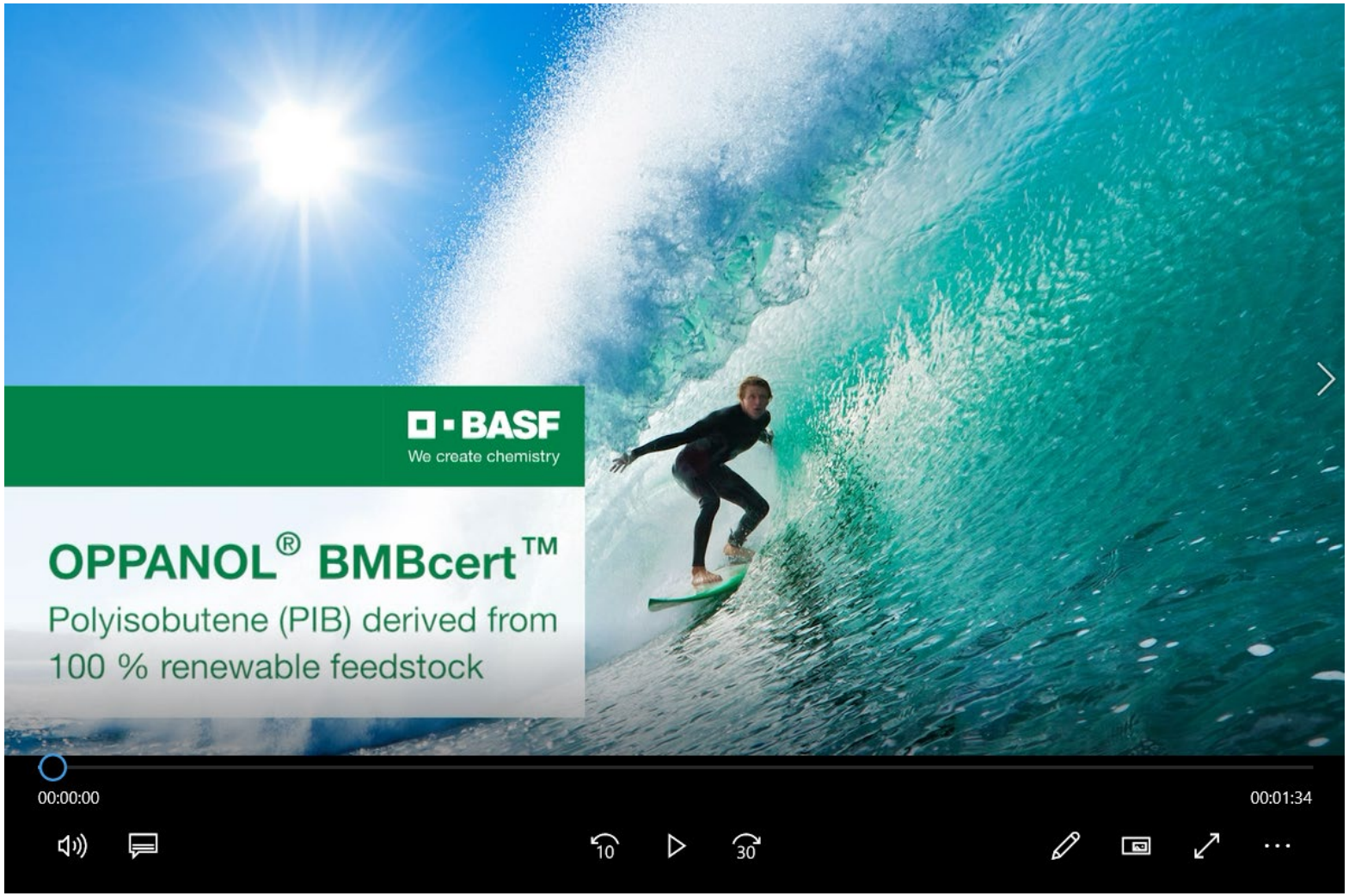
Saving of fossil resources and reduction of CO_2 footprint

High quality – identical performance

- **Bio-feedstock** (biogas) fulfils the GHG emission reduction requirements of the Renewable Energy Directive (RED)
- **Carbon footprint reduction** expressed as the number of CO2 equivalents per kg product*
- **Drop-in solution**, without compromise on performance and quality

* Self-assessment according to ISO 14021

OPPANOL® BMBcert™



Disclaimer

The declaration and information given herein is exclusively provided for our customers and the respective competent authorities.
It is not intended for publication either in printed or electronic form (e.g. via Internet) by any third party. Neither partial nor full publication is allowed without the prior written permission of BASF.
The data indicated above are the results of our investigations, correspond to the state-of-the-art and are based on our current knowledge and experience. The data refer to the state of the laws at the date of issue.

BASF produces a wide variety of high quality polyisobutylenes marketed by BASF under the trademark OPPANOL® that satisfy the manifold requirements of our customers, including products that may meet the specifications for use in food, medical, pharmaceutical or cosmetics applications.
BASF has proven expertise in supporting and working with our customers in the innovative use and application of our materials.

However, BASF has not designed or tested its OPPANOL® grades with respect to special requirements related to their use in medical devices (defined in the European, US or other local medical device legislation), pharmaceuticals and cosmetics.
In view of the many factors that may affect the processing and use of our OPPANOL®, the data in this publication do not relieve processors of the responsibility to carry out their own inspections and tests, neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose.
Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior notice and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient to ensure that all proprietary rights, laws and legislation are observed.
BASF does not recommend the use of or claim the suitability of OPPANOL® in a specific application and, therefore, the decision to use OPPANOL® is solely at the customer's own risk. It is the responsibility of the customer to determine whether their manufacturing process and the end application using OPPANOL® is safe, lawful and technically suitable for the intended use. BASF extends no warranties or guarantees, express or implied, concerning the suitability of OPPANOL® for any specific application, especially for a possible use in medical, pharmaceutical or cosmetics applications. Moreover, BASF does never supply its OPPANOL® products for the manufacture of implants.
This product information expires 18 months after the date mentioned above or in case of regulatory changes. Please ask for a new information if needed.

We create chemistry

Medium Molecular Weight

OPPANOL® B

Other OPPANOL® B BMBcert™ grades, upon request

Typical characteristics

	OPPANOL®	Viscosity in solution (isooctane, 20°C) Concentration [g/cm³]	Staudinger Index (J_0)	Average molecular weight, viscosity average (M_v) [g/mol]	Stabilized [with BHT]
Medium molecular weight	B 10 SFN	0.01	27.5 - 31.2	40,000	no
	B 10 SFN BMBcert™	**0.01**	**27.5 - 31.2**	**40,000**	**no**
	B 10 N	0.01	27.5 - 31.2	40,000	yes
	B 11 SFN	0.01	30.7 - 36.0	47,000	no
	B 12 SFN	0.01	34.5 - 39.0	55,000	no
	B 12 N	0.01	34.5 - 39.0	55,000	yes
	B 12 SFN BMBcert™	**0.01**	**34.5 – 39.0**	**55,000**	**no**
	B 12 N	0.01	34.5 – 39.0	55,000	yes
	B 13 SFN	0.01	39.0 - 43.0	65,000	no
	B 14 SFN	0.01	42.5 - 46.4	73,000	no
	B 14 N	0.01	42.5 - 46.4	73,000	yes
	B 15 SFN	0.01	45.9 - 51.6	85,000	no
	B 15 SFN BMBcert™	**0.01**	**45.9 – 51.6**	**85,000**	**no**
	B 15 N	0.01	45.9 - 51.6	85,000	yes

High Molecular Weight

OPPANOL® N

OPPANOL® N BMBcert™ grades, not yet available

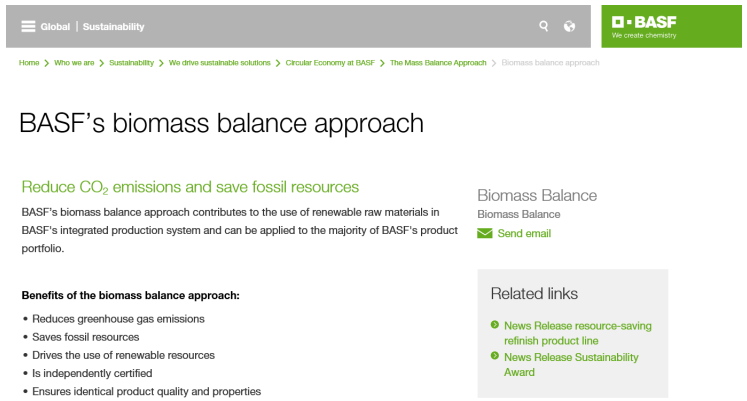
Typical characteristics

	OPPANOL®	Viscosity in solution (isooctane, 20°C) Concentration [g/cm³]	Staudinger Index (J_0)	Average molecular weight, viscosity average (M_v) [g/mol]	Stabilized [with BHT]
High molecular weight	N 50	0.002	128 - 150	425,000	yes
	N 50 SF	0.002	128 - 150	425,000	no
	N 80	0.002	178 - 236	800,000	yes
	N 100	0.002	241 - 294	1,110,000	yes
	N 150	0.001	416 - 479	2,600,000	yes

We create chemistry

Questions about BASF's Biomass Balance approach? Get more information…

Watch a short video on the BASF biomass balance approach.



https://www.basf.com/global/en/who-we-are/sustainability/we-drive-sustainable-solutions/circular-economy/mass-balance-approach/biomass-balance.html

https://www.redcert.org/en/