BIOVOX

Life Cycle Assessment

bioPE-based MedEco Grades (IPI, IPI C1, IPI C3, IPI C4, IPI C6, XPI C2, XPI C3, XPI C4)

At BIOVOX we want to deliver reliable sustainability facts, to showcase the exact environmental impact of our MedEco Bioplastics. This LCA fact sheet provides exactly these verified insights. Enjoy reading – and feel free to ask us anything about it!

LCA Analysis in a Nutshell:

- ✓ ISO 14040/44 & 14067 compliant, PAS 2090 aligned
- ✓ Scope: cradle-to-gate (from raw material extraction to production incl. packaging materials and transport)
- ✓ Functional Unit: 1 kg bioPE-based MedEco Grade incl. packaging
- ✓ 16 Impact Categories were assessed
- ✓ The LCA study distinguishes between biogenic and fossil greenhouse gas emissions
- ✓ The carbon footprint of bioPE-based MedEco grades ranges from -1,54 to -2,08 kg CO2e
- ✓ Up to 190 % lower climate impact compared to conventional fossil-based plastics

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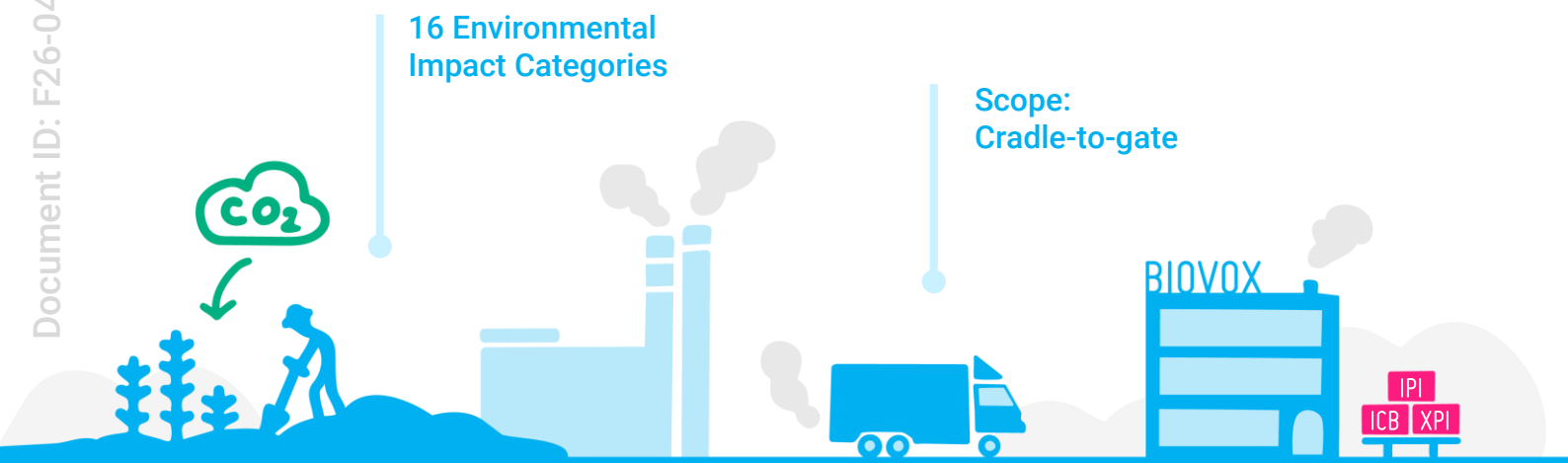


NEXT PAGE: KEY RESULTS

Executive Summary

Overview Scope

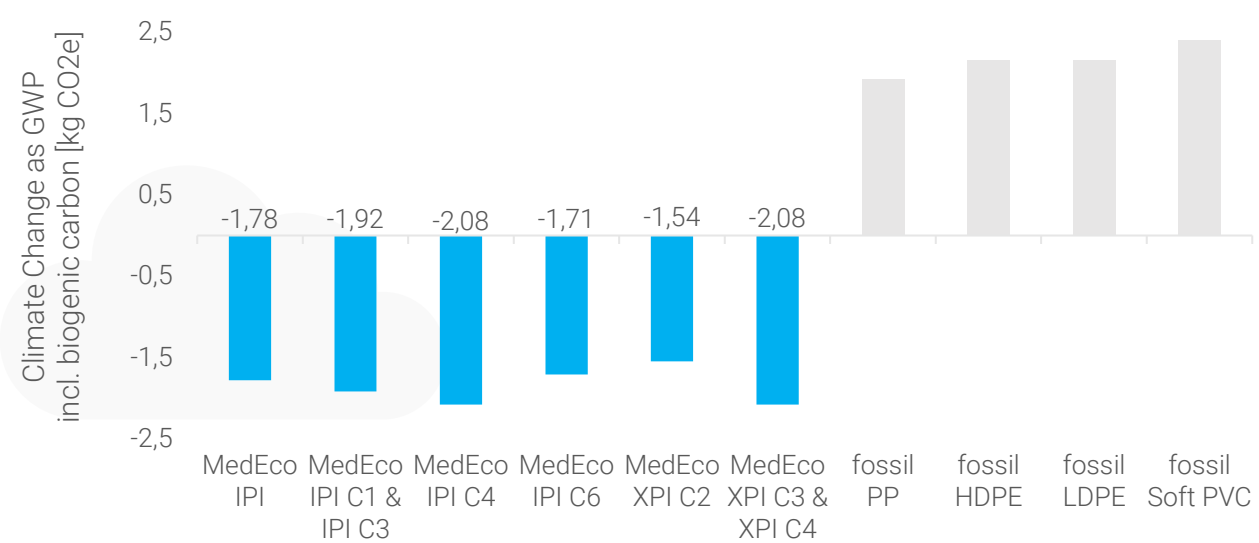
Below is a brief summary of the LCA Scope. For details on methodology, please refer to >>page 3.

- **Objective:** Quantify the environmental impact across the selected stages of the product life cycle
- **Products:** bioPE-based MedEco Grades (IPI, IPI C1, IPI C3, IPI C4, IPI C6, XPI C2, XPI C3, XPI C4)
- **Approach**: Compliant with ISO 14040/44 & 14067, aligned with PAS 2090
- **Scope:** Cradle-to-gate (from raw material extraction to the factory gate, incl. packaging)
- **Impact Categories:** 16 impact categories assessed through EF v3.1 no LT methodology
- **Functional Unit:** 1 kg bioPE-based MedEco Grades incl. packaging
- **Data**: BIOVOX data from 2024 & 2025, supplier LCAs (2020-2024), literature, ecoinvent 3.10.1

Key Result: Carbon Footprint

Take a look at the chart below for the key LCA results of climate change across the life cycle stages from cradle to BIOVOX production gate. MedEco PE Grades can achieve a reduction in carbon footprint of up to 190% compared to conventional fossil-based plastics.

For detailed results of other impact categories, please refer to >>page 4.

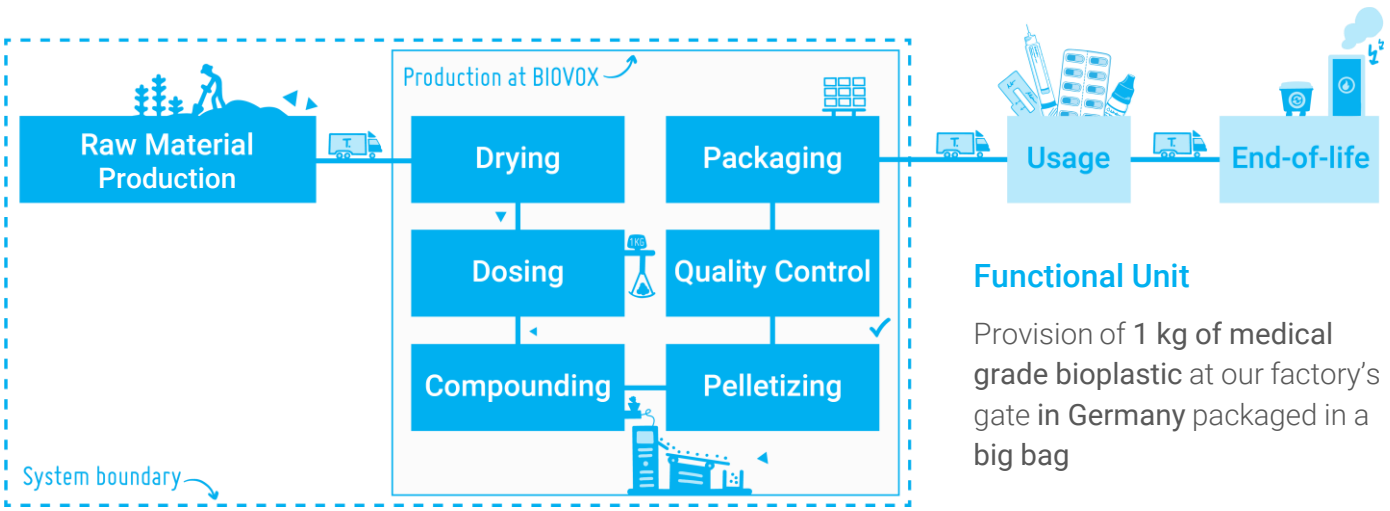


Comparison between bioPE-based MedEco Grades incl. packaging and conventional fossil-based plastics.
Data on carbon footprint for fossil-based polymers from PlasticsEurope's Eco-profiles, does not include transport, compounding or packaging.

NEXT PAGE: METHODOLOGY & SCOPE →

Methodology & Scope

The modeling approach chosen for conducting the LCA is based on the bottom-up method. Data collection was carried out in a multi-stage process in collaboration with internal and external stakeholders. Below, you can find more information about the scope:

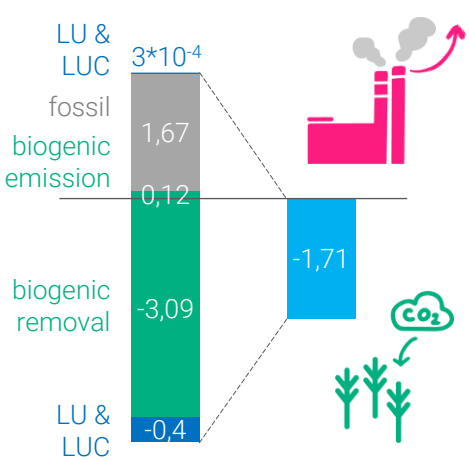


Functional Unit

Provision of **1 kg of medical grade bioplastic** at our factory's gate **in Germany** packaged in a **big bag**

Biogenic Carbon Accounting -1/+1

- This LCA study reports biogenic and fossil greenhouse gas flows separately, in accordance with ISO 14067.
- GHG emissions to the atmosphere are shown as positive flows; GHG removals as negative flows, accurately reflecting the temporary storage of carbon in the product.
- If fossil and biogenic carbon flows are aggregated into a total carbon footprint within a cradle-to-gate scope, this must be clearly indicated as "including biogenic carbon".
- In a cradle-to-grave scope, the net biogenic carbon balance is typically zero, as both removals and emissions are counted.



LU & LUC = land use and land use change, negative total value due to carbon-storing agricultural practice

Fossil and biogenic greenhouse gas emissions from processing, transport, and energy use

Biogenic carbon uptake during plant growth

Sum = total carbon footprint including biogenic carbon

Detailed breakdown of carbon footprint by carbon origin for MedEco IPI C6

In Scope

- Raw material production, incl. packaging and transport
- Energy production and consumption
- Production process at BIOVOX from drying to packaged MedEco pellets

Out of Scope

- Warehousing, distribution, conversion to and use of end products, EOL
- Raw materials and packaging components with <1% of the mass of the functional unit
- Life cycle of the machines, equipment, and buildings

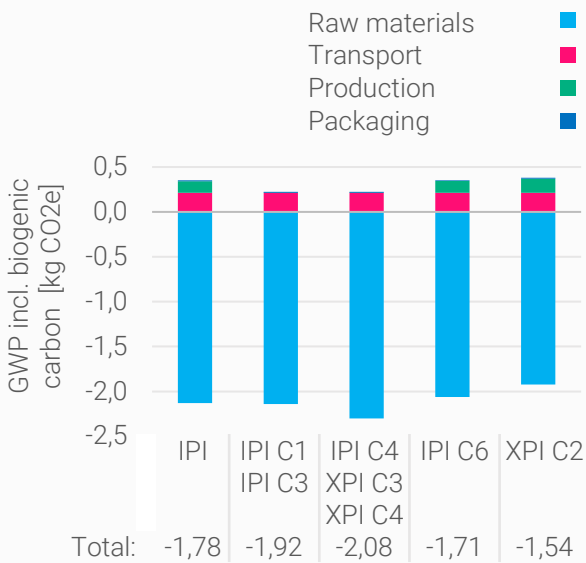
NEXT PAGES: DETAILED RESULTS

Detailed Results

Here you can find detailed results for the most important and relevant impact categories: Climate change, land use and water use. They are broken down by the life cycle phases of raw material, operating and auxiliary materials, production process, and transport. The results serve to identify hotspots and communicate environmental impacts transparently.

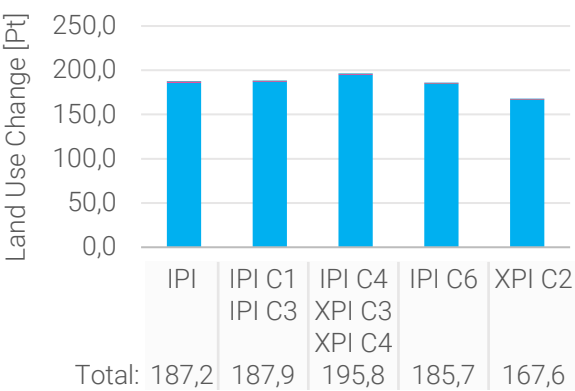
Impact Category: Climate Change (GWP including biogenic carbon)

- The differences between the carbon footprints of the product variants are mainly due to their raw material compositions.
- Depending on the formulation, 84-91% of emissions are from raw materials, 8-9 % from transport emissions, 0-7% from production and <1% from packaging.
- Emission data from ecoinvent used for transport modelling is relatively conservative.



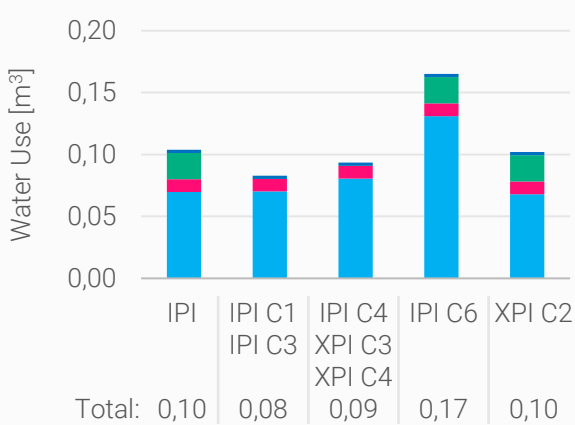
Impact category: Land Use (LU)

- For all product variants, raw material production accounts for >99% of land use mainly due to agricultural activities for the biobased polymer .
- MedEco XPI C2 has the lowest impact due to its lower biobased content.



Impact category: Water Use (WU)

- For all product variants, raw material production accounts for 67-86% of water use primarily due to agricultural activities for the biobased polymer and up to 21% stems from the energy used in production.
- MedEco IPI C6 has the highest impact due to its mineral component.



NEXT PAGES: DETAILED RESULTS

Detailed Results – Injection Moulding Grades

The aggregated results for all product variants for all impact categories including a break down of climate change into emissions from biogenic, fossil and land use.

Impact Category		Unit per FU	MedEco IPI	MedEco IPI C1	MedEco IPI C3	MedEco IPI C4	MedEco IPI C6
Climate change	Total	kg CO2 eq	-1,78	-1,92	-1,92	-2,08	-1,71
	Biogenic		-3,01	-3,05	-3,05	-3,04	-2,98
	Fossil		1,64	1,54	1,54	1,38	1,67
	LU & LUC		-0,41	-0,41	-0,41	-0,42	-0,40
Ozone depletion		kg CFC11 eq	1,29E-07	1,29E-07	1,29E-07	1,34E-07	1,29E-07
Ionizing radiation: human health		kBqU-235 eq	0,02	0,01	0,01	0,01	0,02
Photochemical ozone formation: human health		kg NMVOC eq	0,02	0,02	0,02	0,02	0,02
Particulate matter		disease inc.	3,26E-07	3,26E-07	3,26E-07	3,25E-07	3,27E-07
Human toxicity, non-carcinogenic		CTUh	3,73E-08	3,68E-08	3,68E-08	3,74E-08	3,76E-08
Human toxicity, carcinogenic		CTUh	1,89E-09	1,72E-09	1,72E-09	1,72E-09	2,09E-09
Acidification		Mol H+ eq	0,06	0,06	0,06	0,06	0,06
Eutrophication, terrestrial		kg N eq	0,16	0,16	0,16	0,16	0,16
Eutrophication, freshwater		kg P eq	1,15E-03	1,11E-03	1,11E-03	1,11E-03	1,20E-03
Eutrophication, marine		mol N eq	0,03	0,03	0,03	0,03	0,03
Ecotoxicity, freshwater		CTUe	171,00	171,49	171,49	178,85	170,06
Land use		Pt	187,23	187,90	187,90	195,79	185,71
Water use		m3depriv	0,10	0,08	0,08	0,09	0,17
Energy resources: non-renewable		MJ	10,28	8,68	8,68	9,13	10,85
Material resources: metals/minerals		kg Sb eq	3,26E-06	3,08E-06	3,08E-06	3,17E-06	3,52E-06

NEXT PAGES: DETAILED RESULTS →

Detailed Results – Extrusion Grades

The aggregated results for all product variants for all impact categories including a break down of climate change into emissions from biogenic, fossil and land use.

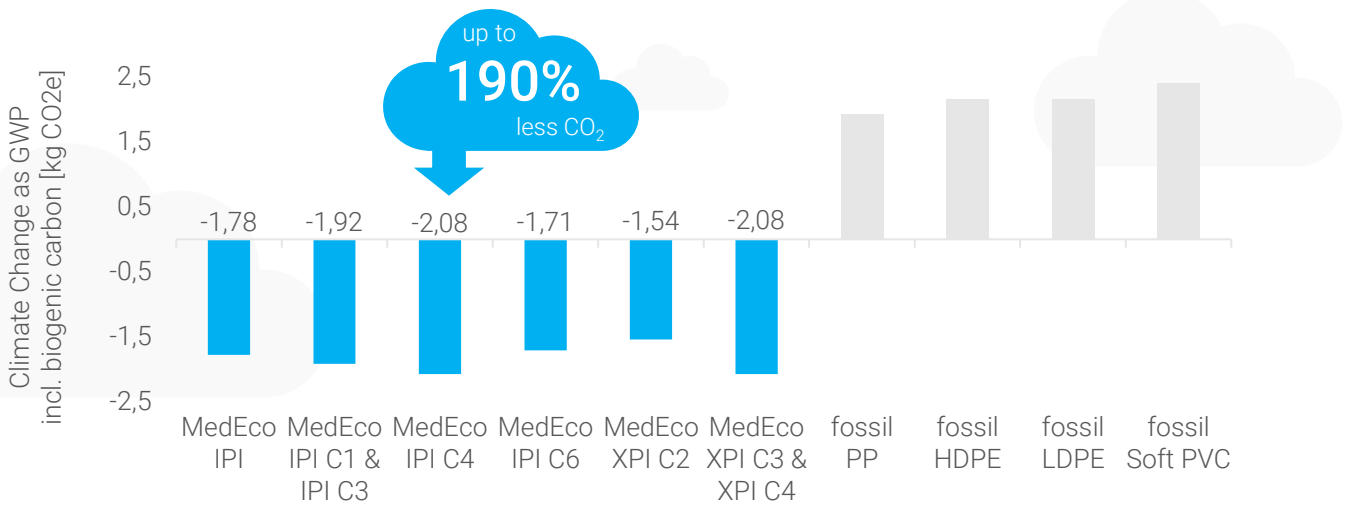
Impact Category		Unit per FU	MedEco XPI C2	MedEco XPI C3	MedEco XPI C4
Climate change	Total	kg CO2 eg	-1,54	-2,08	-2,08
	Biogenic		-2,71	-3,04	-3,04
	Fossil		1,53	1,38	1,38
	LU & LUC		-0,36	-0,42	-0,42
Ozone depletion		kg CFC11 eq	1,44E-07	1,34E-07	1,34E-07
Ionizing radiation: human health		kBqU-235 eq	0,01	0,01	0,01
Photochemical ozone formation: human health		kg NMVOC eq	0,02	0,02	0,02
Particulate matter		disease inc.	2,89E-07	3,25E-07	3,25E-07
Human toxicity, non-carcinogenic		CTUh	3,33E-08	3,74E-08	3,74E-08
Human toxicity, carcinogenic		CTUh	1,82E-09	1,72E-09	1,72E-09
Acidification		Mol H+ eq	0,05	0,06	0,06
Eutrophication, terrestrial		kg N eq	0,14	0,16	0,16
Eutrophication, freshwater		kg P eq	1,13E-03	1,11E-03	1,11E-03
Eutrophication, marine		mol N eq	0,03	0,03	0,03
Ecotoxicity, freshwater		CTUe	153,42	178,85	178,85
Land use		Pt	167,63	195,79	195,79
Water use		m3depriv	0,10	0,09	0,09
Energy resources: non-renewable		MJ	13,32	9,13	9,13
Material resources: metals/minerals		kg Sb eq	3,00E-06	3,17E-06	3,17E-06

NEXT PAGE: CONCLUSION

Conclusion, Comparison & Outlook

Comparison

Compared to fossil-based plastics on a cradle-to-gate basis, our bioPE-based MedEco Grades can achieve a reduction in carbon footprint of up to 190%. It should be noted, that the carbon footprint of **BIOVOX MedEco includes compounding, transport from the country of origin of the raw materials as well as packaging**, all of which are usually excluded in general material footprints. Consequently, the actual difference between the end product may be even greater.



Comparison between bioPE-based MedEco Grades incl. packaging and conventional fossil-based plastics.
Data on carbon footprint for fossil-based polymers from PlasticsEurope's Eco-profiles, does not include transport, compounding or packaging.

Conclusion

The LCA identifies raw materials as the main environmental hotspots, followed by production, and transport. The results show that biobased, circular materials—such as bioPE-based MedEco Grades —can be an important element to advance low-carbon, future-proof solutions.

Outlook

Further reductions are possible through recycling at end of life and the use of circular raw materials such as circular lactic acid. We continuously work on improving our solutions and will keep you updated on future developments.

Questions? Feedback?

Feel free to reach out using the contact details on the next page →

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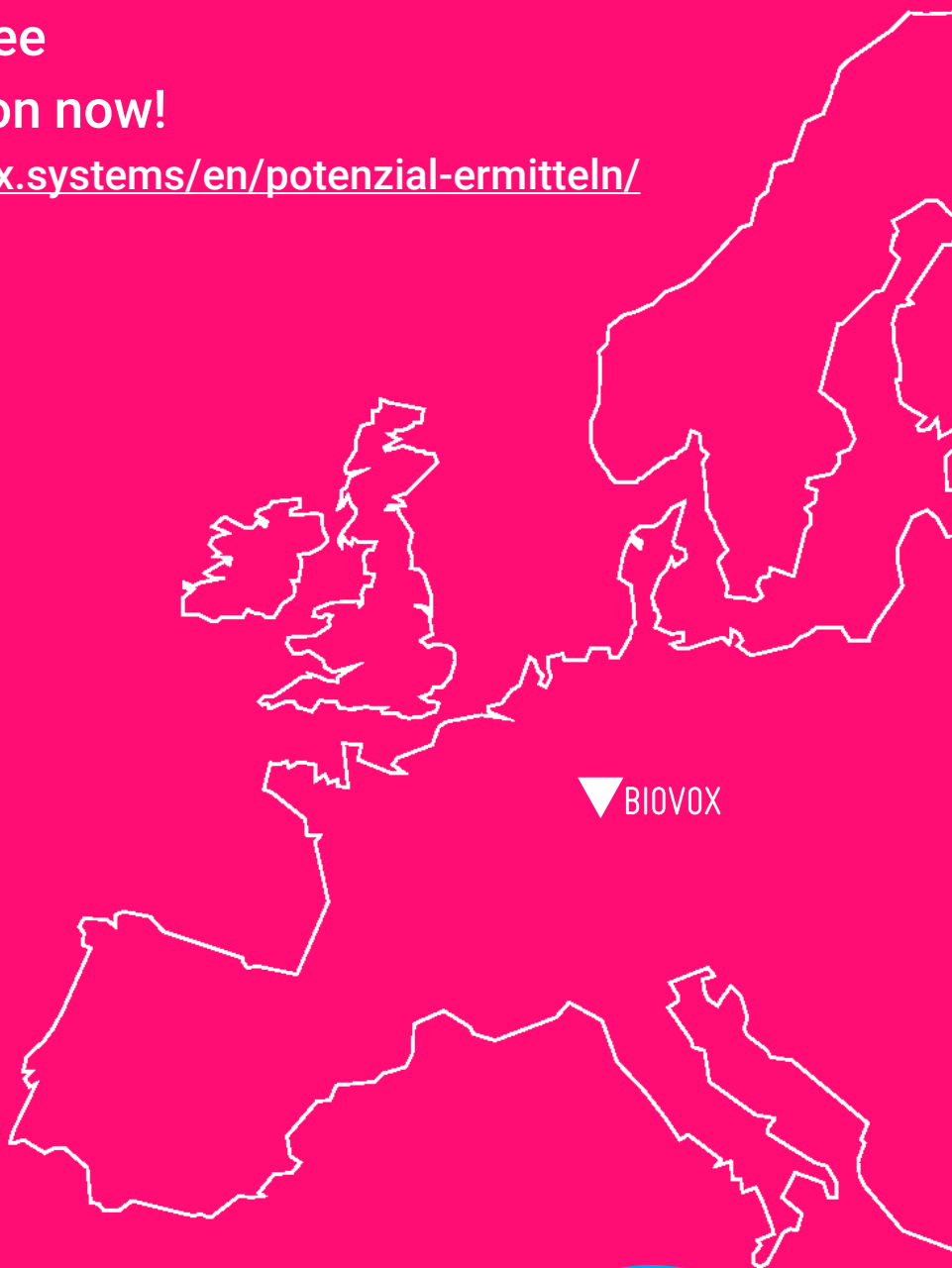

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