



BIONEER

Scaled-up production of next-generation carbohydrate-derived building blocks to enhance the competitiveness of a sustainable European chemicals industry



The BIONEER Project and its Consortium

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The platform chemicals sector is currently heavily reliant on fossil fuels. Additionally, biobased platform chemicals are produced in small volumes, often from crops that divert resources from food supplies and have high environmental impacts due to land use and supply cycles. While lignocellulosic feedstocks—particularly residues—offer a more sustainable option, the range of chemicals produced from these sources at scale has been limited. Moreover, the functionality of fossil-based platform chemicals is challenging to replicate with existing biobased alternatives.

BIONEER, which addresses the call topic HORIZON-JU-CBE-2023-IA-06: Selective, sustainable production routes towards bio-based alternatives to fossil-based chemical building blocks, under grant agreement N° 101157779, aims to tackle this by demonstrating the production of new carbohydrate-derived building blocks and platform chemicals at TRL 6/7.

BIONEER's main goal is to expand the variety of biobased building blocks and platform molecules by scaling up the production of novel molecules and polymers from lignocellulosic biomass. Using a unique blend of microbial and chemical production methods, BIONEER will deliver products suited for coatings and personal care, with an eye on the packaging sector in a zero-waste approach. Focused on utilizing cost-effective, sustainably sourced lignocellulosic biomass, BIONEER produces innovative platform chemicals for industries that are challenging to decarbonize, such as personal care and coatings.

Advancing sustainable biobased chemicals: the BIONEER project's mission to replace fossil-based materials

BIONEER's approach builds on second-generation carbohydrate-derived chemicals, applying the consortium's expertise in biotechnology, biochemistry, and chemistry to scale up production of novel monomeric and polymeric building blocks, providing enhanced functionalities. Leveraging outcomes from the [EnXylaScope](#) and [PERFECOAT](#) projects, BIONEER sets the stage to advance these results through industrial demonstration with a focus on market uptake.

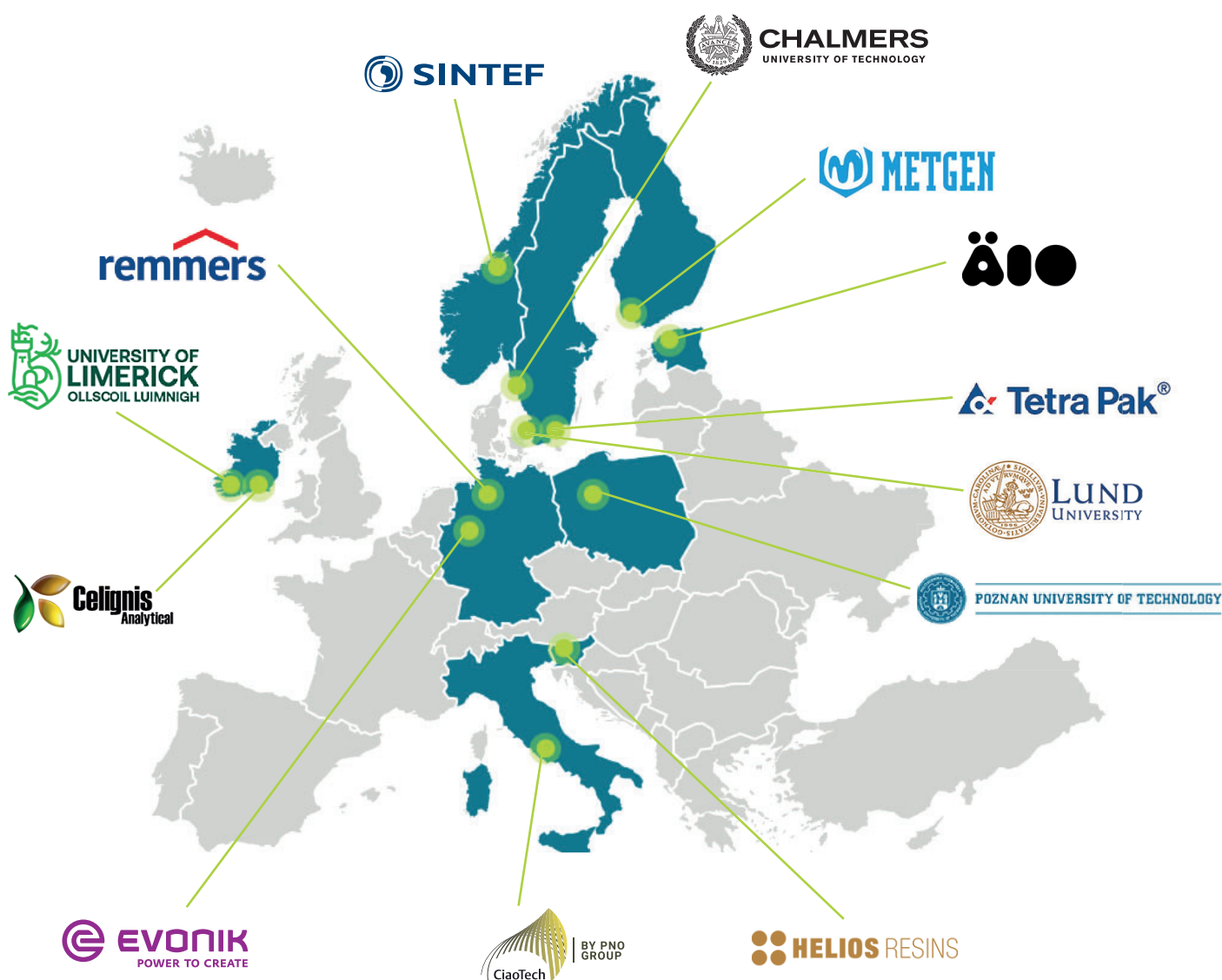
BIONEER Building Blocks, created from sustainably sourced biomass using bio- and chemo-catalytic processes, are designed to replace toxic, environmentally harmful fossil-based materials, including bisphenol A (for UV-curable coatings) and derivatives like alkyl acrylates, vinyl pyrrolidine, vinyl acetate, and siloxanes (for personal care). Process residues will also be assessed for packaging applications.

BIONEER will introduce an innovative approach to refining plant-based feedstocks, starting with sugar streams from biorefineries to produce essential compounds through microbial and enzymatic processes. The project will initially target the furniture coatings and personal care markets, where sustainable alternatives are needed for hard-to-replace materials. The project will also demonstrate new methods for converting local plant residues into components that replace imported fossil-based inputs in the coatings and personal care sectors. By following circular economy principles, BIONEER will promote resource efficiency and sustainable biomass use, delivering benefits across the entire production chain.



Uniting expertise across Europe: BIONEER consortium embarks on a 48-month journey to replace fossil-based materials with sustainable biomass solutions

The BIONEER consortium comprises 13 partners from 9 European countries, combining expertise in industrial biotechnology, chemical synthesis and process development, biopolymer processing, enzymatic and chemo-synthetic carbohydrate tailoring, and upscaling skills and infrastructure, alongside cutting-edge industrial technology and innovation in bio-based solutions.





SINTEF, one of Northern Europe's largest independent research organizations with over 2000 employees, conducts contract research for Norwegian and European industries and participates in numerous publicly funded projects. With dedicated staff for EU project administration, SINTEF brings expertise to BIONEER through three institutes: SINTEF Industry, SINTEF Community, and SINTEF Digital. Together, they contribute to overall project coordination and cover biotechnology, chemical process development, environmental sustainability, and social sustainability assessments.



Celignis, a spin-off from the University of Limerick, specializes in rapid biomass analysis, offering high-throughput and precise services for bioenergy and biorefinery clients worldwide. With a well-equipped lab and skilled team, Celignis provides bespoke bioprocessing solutions (enzymatic hydrolysis, extraction, pretreatment, fermentation) and conducts research to develop IP for biomass and residue valorization. The company focuses on xylan extraction technologies and its modification for diverse product applications.



Evonik, a global leader in specialty chemicals, provides solutions for the beauty and personal care market across active ingredients, skincare, haircare, cleansing, and alternative preservation. Known for its sustainable additives, such as emulsifiers (Tagat® and TEGO® Care), thickeners (dermofeel®), and biosurfactants (Rheance® One, Sophance® LA-A), Evonik has contributed to projects like BBI PERFECOAT and EU Horizon's VALUABLE. In BIONEER, Evonik will lead WP4, testing biobased polymer samples for personal care applications (skin and hair care) and conducting chemical safety assessments to ensure safe, sustainable product development.



The PNO Group, founded in 1984, is a European network of over 400 professionals across 9 countries. Supporting over 3,000 clients annually, PNO drives R&D with data-driven analysis and develops over 300 innovative projects each year. Known for effective dissemination and exploitation plans across various sectors, PNO is represented in this project by its Italian branch, **CIAOTECH** S.r.l., which specializes in R&D advisory, innovation management, and funding. In BIONEER, CIAOTECH will lead WP6, focusing on market uptake through dissemination, communication, and exploitation activities.



MetGen Oy, an innovative biotech SME founded in 2008 in Kaarina, Finland, designs and markets specialized enzymatic solutions. Its enzyme products, MetZyme®, are industrial catalysts capable of accelerating reactions even in harsh environments, enabling unique applications. MetGen's breakthrough technologies—ENZINE® for enzyme development and METNIN™ for lignin valorization—support sustainability in industries like pulp & paper, biofuels, and biochemicals. ENZINE® has led to successful industrial trials in renewable chemicals, while METNIN™ refines lignin for applications in packaging, films, and foams. In BIONEER, MetGen will lead WP3, focusing on the chemical and enzymatic refinement of carbohydrate-based compounds, upscaling enzymes for project needs and piloting METNIN™ to valorize lignin side streams from lignocellulosic biomass.



ÄIO owns a unique non-GMO microorganism capable of producing animal fat, palm oil, and components similar to coconut and cocoa butter. This biotechnology-based fat production is highly resource-efficient, using by-products from the food and wood industries as substrates and enabling vertical production, saving land and preserving biodiversity. ÄIO's first product, RedOil, is a biologically encapsulated oil enriched with antioxidants and omega-3s, serving as an alternative to palm and coconut oil. Higher-value products will also be developed via precision fermentation with engineered microbial strains.



The **University of Limerick** is an internationally focused university on Ireland's west coast, known for excellence in education, research, and innovation. UL excels in materials science, health sciences, ICT, and sustainable development, with strong industry links and a focus on translating research into real-world benefits. In BIONEER, UL's Principal Investigator, Prof. Maurice N. Collins, a Materials Scientist in the School of Engineering, brings extensive experience from European and national projects. His team applies the cascading principle to maximize value from biological resources, producing advanced materials for automotive, biomedical, and energy applications.



Founded in 1666, **Lund University** hosts 40,000 students and 7,400 staff across its campuses in Lund, Helsingborg, and Malmö. Consistently ranked among the world's top 100 universities, Lund has partnerships in over 70 countries. The Biotechnology division, part of the engineering faculty, emphasizes environmental sustainability, aligning well with BIONEER's goals. Prof. EN Karlsson's research group, with around 10 students and postdocs, focuses on enzyme-driven carbohydrate modification and biomass valorization. Prof. Ola Wallberg from Chemical Engineering also contributes his expertise in techno-economic analysis (TEA) to the BIONEER project.



Remmers Industrielacke, a family-owned company in Germany's furniture hub, has grown from a local paint supplier to a technology-driven partner for the global furniture and flooring industry. Specializing in eco-friendly coatings like waterborne and UV-curable options, Remmers serves clients such as IKEA, offering tailored solutions and technical support. With a focus on the EU market, Remmers supplies industrial customers worldwide, coating over 250 million m² of surfaces annually.



Helios Resins, a business unit of Kansai Helios, produces around 70,000 tons of liquid resins annually, including trusted brands like DOMACRYL and DOMOPOL, serving over 50 countries. Known for quality, Helios Resins holds ISO and Responsible Care certifications and recently received the EcoVadis Gold label. In BIONEER, Helios will develop low-impact polymers for the coatings industry, focusing on reducing carbon footprint and extending product lifespan without sacrificing performance, scaling production up to 50L.



Chalmers University of Technology, located in Gothenburg, Sweden, conducts research and education across fields like life sciences, materials science, IT, nanotechnology, environmental sciences, and energy. With about 10,000 students and 3,000 staff across 13 departments, Chalmers has a strong tradition of industry collaboration and infrastructure for research commercialization. Its annual turnover is 4.3 billion SEK (around 362 million EUR), with 70% dedicated to research and 60% funded through competitive external sources.



Tetra Pak Processing Systems AB, belongs to Tetra Pak group. In 2022 Tetra Pak had a net sale of 12.495 € billion and 23.733 persons employed. Tetra Pak is engaged in the business of developing, manufacturing, and selling processing and packaging systems and services, for liquid and other food products, and has many years' experience, technology, and know-how in such fields. Tetra Pak, as a key player in the food and beverage industry, values the insights and expertise that collaboration with academic institutions brings.



The **Faculty of Chemical Technology at Poznan University of Technology** offers high-quality education and innovative research in chemical technology. Prioritizing partnerships with industry and adapting to socio-economic challenges, the Faculty aims to transfer research to industry, tailor education to job market needs, and involve industry experts in teaching. In BIONEER, PUT will integrate advanced digital tools into industrial processes, focusing on quantum modeling, flow-sheeting, and computational fluid dynamics (CFD). Tasks include optimizing process conditions to enhance scaling efficiency and collaborating with partners for information sharing and activity coordination. A key deliverable will be an AI-assisted computational analysis report on chemical kinetics, due in month 12.



On July 1-2, 2024, the BIONEER consortium gathered in Trondheim, Norway for the project kick-off meeting. Over the next 48 months, we will demonstrate the incredible potential of lignocellulosic biomass to replace fossil-based materials in furniture coatings and personal care products.

Partners



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