PENGUIN

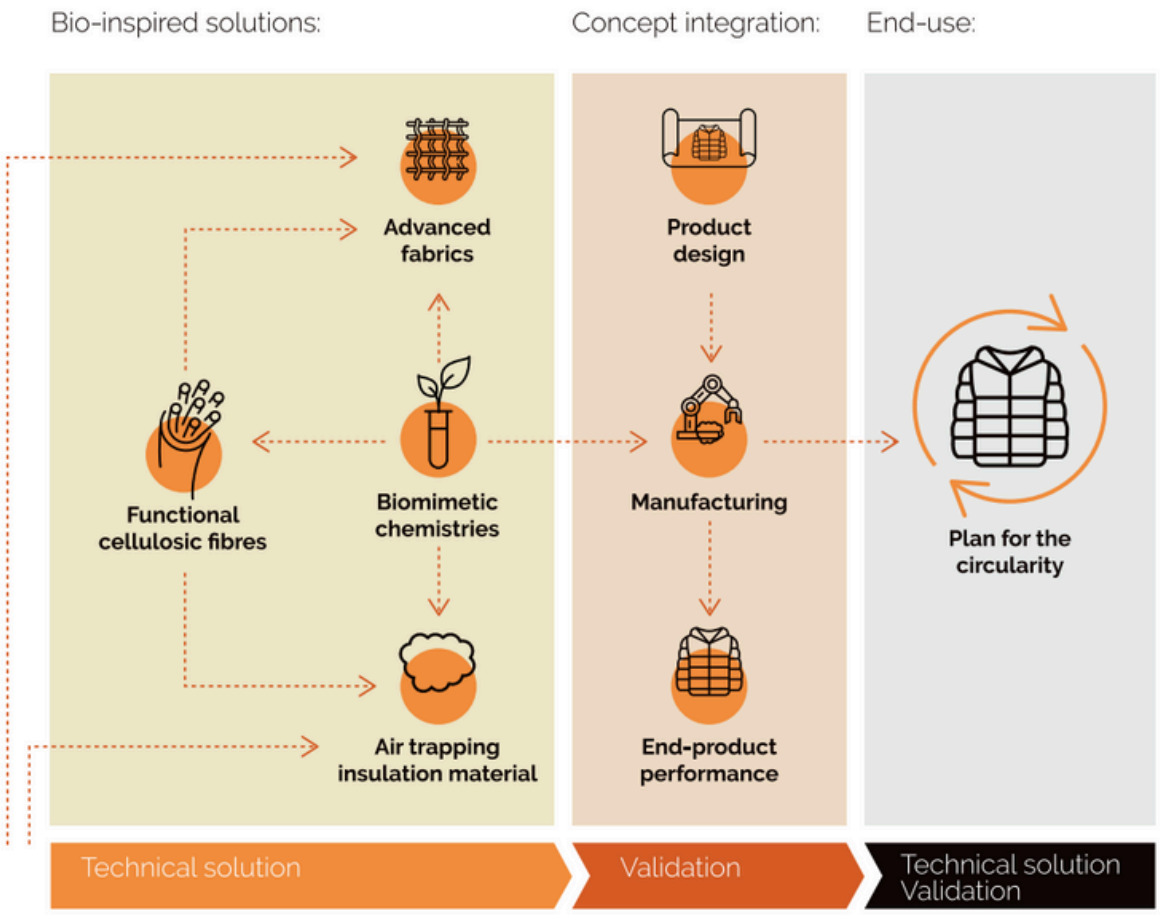
Bioinspired and advanced fibres and materials for sustainable outdoor textiles with biomimetic functionalities

2nd NEWSLETTER

June 2025

First year recap in *PENGUIN*

The PENGUIN project is making strong progress across all key innovation pillars, following a clear trajectory from bioinspired material development to circular, high-performance garment prototypes. The project's overarching objective, to replace synthetic outdoor textiles with safe, sustainable, and high-performing cellulose-based alternatives, is being addressed through different interconnected actions. The first year has seen important achievements: functional cellulosic fibres have been produced and chemically treated for enhanced water resistance; insulation materials have been formulated and tested for strength, packability, and durability; and advanced fabrics have been spun and are now undergoing sustainable finishing treatments. Computational tools and SSbD assessments are actively guiding design choices, ensuring environmental and toxicological safety and sustainability from the outset. Meanwhile, communication and dissemination efforts have raised awareness among stakeholders and begun introducing PENGUIN's innovations to the textile market. Below, we present highlights from each area of work and the milestones achieved so far.



First year recap in *PENGUIN*

Functional cellulosic fibres

During the first year, the development of functional cellulose-based fibres has been one of the cornerstones of the PENGUIN project. VTT and Spinnova have successfully produced multiple batches of fibres using their proprietary technologies, enabling preliminary trials and evaluations. OrganoClick has validated its hydrophobisation chemistries, such as OrganoTex®, on fibres developed by both VTT and Spinnova, confirming compatibility and effectiveness in terms of wet and dry strength, water resistance, and washability. In parallel VTT has launched gas-phase hydrophobisation trials for cellulosic fibres, and reference fibres have already been characterised. These combined efforts have laid a solid foundation for scaling up fibre production and functionalisation for advanced applications.

First year recap in PENGUIN

Advanced insulation material

Substantial progress has been made by VTT and MOLINA in the development of cellulose-based insulation materials. A wide range of cellulose-based fibres from project partners (VTT and Spinnova) and commercial sources have been tested co, leading to the identification of promising fiber combinations for the different insulation material production technologies. . Spinnova and Biocelsol fibers have shown strong compatibility with these forming methods, delivering good strength characteristics and valuable insights into pore size distribution. Optimization efforts explored different binder systems, with a bio-based solution from OrganoClick demonstrating excellent performance, significantly enhancing both dry and wet strength of the sheets. The resulting soft samples also exhibited high durability under extended mixing. In parallel, MOLINA's work on loose-fill insulation materials using Spinnova fibers with various finishings achieved results in line with established performance benchmarks. Materials and fibers properties and behavior were found to be potentially suitable for outdoor applications. COLMAR and Pangaia Grado Zero contributed by providing reference materials and specifications, ensuring that technical developments align with real-world market expectations. Initial results suggest strong potential for the insulation materials to meet the performance demands of outdoor garments.

First year recap in **PENGUIN**

Advanced fabrics

In the area of fabric development, CITEVE demonstrated the feasibility of processing SPINNOVA fibers by successfully blending them at 50% with virgin cotton yarns using standard lab-scale spinning equipment, an important step toward their adoption in textile production. Efforts to enhance these fabrics are now centered on the application of sustainable finishing techniques, such as biomimetic chemistries, while ensuring strong performance in durability, water repellency, and moisture management, which are currently under validation in reference fabrics. Fabric integration and testing will continue over the coming months, including the development of sandwich structures intended for use in jacket prototypes by COLMAR and Pangaia Grado Zero. Work on textile-integrated heating elements has been initiated at VTT. The work aims to explore how electronics that add functionality and performance to the final garment can be integrated with sustainability and recyclability in mind.

First year recap in *PENGUIN*

Computational modeling + SSbD

idener.ai RINA

IDENER.AI and RINA are jointly advancing the implementation of the Safe and Sustainable by Design (SSbD) framework in the project. During 1st project year a holistic toxicity screening was completed for the chemicals used in fibre production and finishing, helping to guide chemical choices based on safety criteria. RINA has led the definition of the goals and scope for the preliminary Life Cycle Assessment (LCA) of the fibre production processes and is working to integrate these results into the SSbD methodology. Together, these tools ensure that sustainability and safety are embedded from the earliest stages of development.

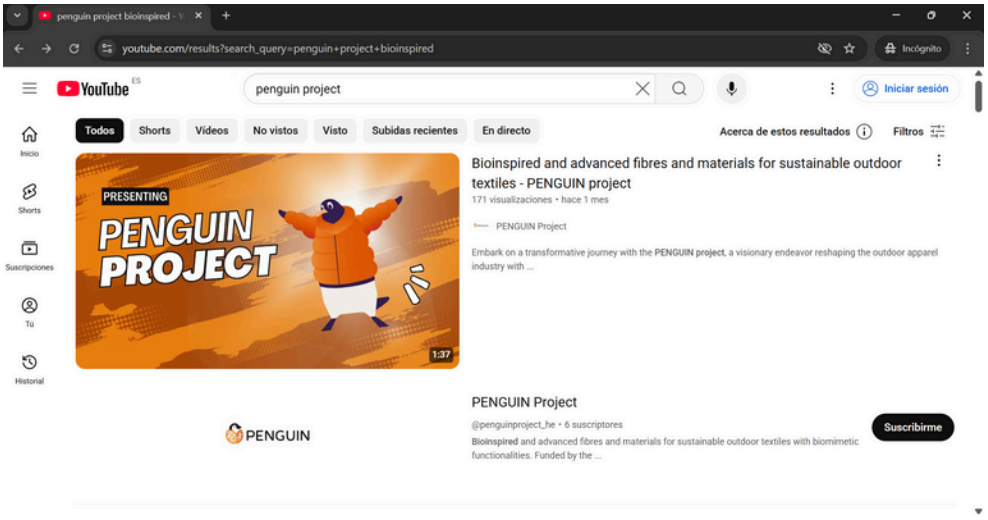
IDENER.AI has applied multi-scale modelling tools to explore the impact of fibre functionalisation and binder-fibre interactions at the molecular level, offering quantitative insight into parameters such as contact angles and interfacial adhesion.

Stakeholder awareness

CONFINDUSTRIA MODA FEDERAZIONE TESSILE E MODA idener.ai

Communication and dissemination activities, led by Confindustria Moda with the support of IDENER.AI, have laid the groundwork for engaging stakeholders across the textile value chain. IDENER.AI launched the project's website and social media channels, published its first newsletter, and produced a promotional flyer and video to present the project's Vsaclidoaptioe and early outcomes. Confindustria Moda has helped raise visibility through targeted outreach in the fashion and textile sectors. and looking ahead, our partner is planning to present the project at key international fairs and events, including Techtextil, Milano Unica, and Première Vision, where PENGUIN's innovations will be introduced to a broader professional audience. Additionally, demo-samples such as an insulation material and textile-integrated heating panel will be available for showcasing in in this fairs and is currently exhibit at ***the New Wood exhibition in Brussels***.

Communication and ***dissemination***



PENGUIN ***video***

The first PENGUIN video is now available for all of you! Our penguin ambassador invites you to be part of the shift of toward sustainable, biodegradable alternatives in the textile industry.

For those interested in discovering the future of outdoor textiles and how science can mimic nature's perfection, this video is a must watch. It is now available on our **website (www.penguin-project.eu)** and on our **YouTube channel (@penguinproject_he)** .

Join the PENGUIN project on a journey to change the outdoor clothing industry with sustainable, cellulose-based insulation inspired by how penguins stay warm in the cold.

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F2F meeting in Portugal

The consortium's second face-to-face meeting took place in Vila Nova de Famalicão (Porto region) on May 21–22, 2025, continuing the collaborative efforts initiated in Jyväskylä, Finland. A key highlight of the meeting was the visit to the impressive facilities of CITEVE and CeNTI – Centre for Nanotechnology and Smart Materials, where members gained first-hand insight into the latest advances in textile innovation and smart materials.

Beyond reviewing the progress made in each work package, the meeting also featured a collaborative seminar titled "What I Need from Each Work Package to Do My Job?". This dynamic workshop was designed to improve inter-WP communication, clarify mutual expectations, and strengthen integration across the project. It enabled a deeper understanding of how the different components contribute to the overarching goals, fostering a more cohesive and effective approach.

News

PENGUIN at ISPO event at Munich

PLACE: Munich, Germany

DATE: December 2nd

PARTNER: MOLINA, OrganoClick , Confindutria Moda and CITEVE

The **PENGUIN Project** proudly took center stage at the prestigious **ISPO event** in Munich, where sustainability and innovation converged in the textile and fashion industries, with a special emphasis on sports and outdoor performance. Represented by leading partners, including **OrganoClick AB**, **MOLINA**, **Confindustria Moda** and **CITEVE**, the event highlighted groundbreaking initiatives aimed at reducing environmental impact across the textile value chain With the ultimate goal of developing sustainable outdoor puffer jacket prototypes, PENGUIN aligns seamlessly with ISPO's commitment to advancing high-performance and eco-conscious solutions for the future of sportswear.

PENGUIN at Pitti Uomo held in Florence

PLACE: Florence, Italy

DATE: January 14th – 17th

PARTNER: Confindustria Moda

At **Pitti Uomo**, one of the world's premier events for menswear and fashion innovation, the PENGUIN Project captivated audiences with a showcase that artfully combined cutting-edge style and environmental responsibility. Amplified by the support of **Confindustria Moda**, the project highlighted the power of collaboration in driving sustainable transformation across the fashion industry. Attendees explored designs made from recycled and biodegradable materials, an immersive Arctic-themed booth symbolizing conservation efforts, and dynamic talks that brought the project's mission to life.

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Our innovation stood out at Milano Unica

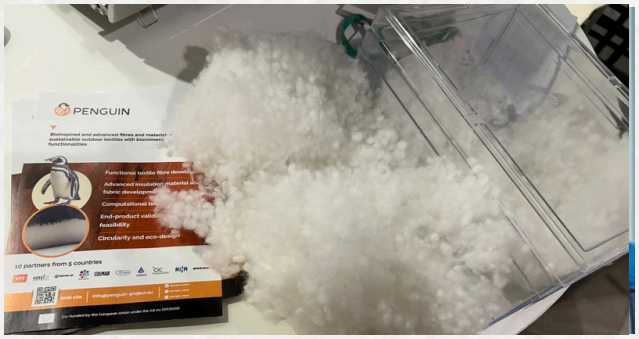
PLACE: Milan, Italy

DATE: February 4-6th

PARTNER: Confindustria Moda and MOLINA

Milano Unica is a key trade show for high-end textiles and accessories, bringing together industry leaders to showcase innovation and foster collaboration. PENGUIN took part to present its mission of developing sustainable materials for outdoor garments, inspired by penguins' natural insulation. Supported by **Confindustria Moda** and **MOLINA**, the project aimed to connect with partners and raise awareness about its work in creating recyclable, biodegradable fibers that support the future of sustainable fashion in Europe.

MOLINA enhances HEIMTEXTIL with our innovations



PLACE: Frankfurt, Germany

DATE: February 25th

PARTNER: MOLINA

At the **Heimtextil** trade fair in Frankfurt, PENGUIN joined forces with partner **MOLINA** to highlight its progress in sustainable textile innovation. As a major event for the home textiles industry, Heimtextil offered the ideal stage to present PENGUIN's eco-friendly, cellulose-based materials and their potential for transforming the sector. The project's presence helped build connections with industry professionals and emphasized its role in advancing greener solutions for interior and home applications.

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PENGUIN presented its video at "Riciclo e riuso delle fibre tessili: tecnologie innovative e soluzioni"

PLACE: Milan, Italy

DATE: March 18th

PARTNER: Confindustria Moda

The conference "***Riciclo e riuso delle fibre tessili: tecnologie innovative e soluzioni***" brought together industry experts to discuss the latest developments in textile recycling. **Confindustria Moda** participated to highlight the **PENGUIN project** and its advancements in recyclable, cellulose-based fibers. The event served as a valuable platform to showcase PENGUIN's role in driving innovation in sustainable textile technologies.

RINA Presents the PENGUIN Project at AperiBio

PLACE: Roma, Italy

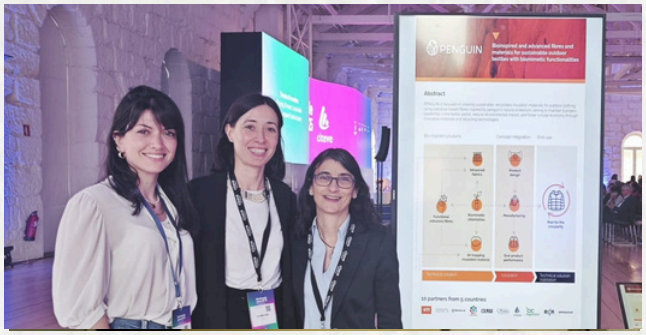
DATE: May 20th

PARTNER: RINA

RINA participated in the **AperiBio** event as part of the **PENGUIN project**'s outreach activities. Held on May 20 at Spazio Europa in Rome, the event was organized by APRE in collaboration with the University of Rome Unitelma Sapienza and the European Commission Representation in Italy, as part of National Bioeconomy Day. AperiBio provided an opportunity to present European bioeconomy initiatives through posters and interactive discussions. RINA showcased the goals and progress of PENGUIN, helping to promote its work on sustainable materials and connect with new partners in the sector.

News

CITEVE at iTechStyle Summit 2025 presenting the PENGUIN Project



PLACE: Porto, Portugal

DATE: May 26-28th

PARTNER: CITEVE

CITEVE represented the **PENGUIN project** at the **7th iTechStyle Summit**, held from May 26 to 28 at Alfândega do Porto. Centered on the theme "Threads of Innovation," the conference gathered global textile industry leaders to discuss smart, sustainable, and transparent solutions. CITEVE highlighted PENGUIN's contribution to bio-based textile development, aligning with the summit's focus on advanced materials, circularity, and innovation.

PENGUIN Project featured at the New Wood exhibition in Brussels

PLACE: Brussels, Belgium

DATE: Since May 26th

PARTNER: VTT

The **PENGUIN project** is featured in **the *New Wood* exhibition**, currently on display at the European Commission's Berlaymont building in Brussels. Opened on May 26 by EU Commissioners Jessika Roswall and Christophe Hansen, alongside Finland's Minister of Agriculture and Forestry, Sari Essayah, the exhibition showcases over **30 wood-based innovations** from Finland. PENGUIN's inclusion highlights its contribution to Europe's green transition, demonstrating how cellulose-based materials can support sustainable, circular bioeconomy solutions on a European scale.

News

UPCOMING *events*

PARTNER	EVENT	YEAR	DATE	LOCATION
Confindustria Moda	Pitti Uomo	2025	June 17-20th	**Florence,** Italy
CITEVE	MOD'Unica	2025	September 27-30th	**Porto,** Portugal
MOLINA	Performance Days	2025	October 29-30	**Munich,** Germany

If you don't want to miss any of the latest news from the PENGUIN project, remember to follow us on our social medias and check out our website.

@penguin-project | @penguin_heproj | @penguin_heproj

Voices from our consortium

VTT

"From VTT we helped shape PENGUIN project it from the beginning. As project coordinators, we brought together a strong consortium around the idea of developing sustainable, high-performance textile solutions rooted in biobased materials. This first year has been about aligning science with application: spinning Biocelsol fibres, validating chemistry, and building trust among partners. Now, we are eager to take the next steps, integrating the fibres into textile systems, developing demonstrators, and proving that circular, functional outdoor materials are possible."

CONFINDUSTRIA MODA

"We believe in making sustainable innovation visible and accessible to the industry. That's why we joined PENGUIN as dissemination leader. Over the past year, we've worked to position the project across fashion, textile and policy ecosystems. Now, with technical results emerging, our focus will shift to amplifying them through key industry fairs like Techtextil, Milano Unica and Première Vision, connecting PENGUIN's breakthroughs with the people who can apply them."

idener.ai

IDENER.AI

"We joined PENGUIN to show how digital tools can accelerate sustainable innovation in textiles. This year we developed simulation frameworks to model fibre functionalisation, contributed to SSbD strategies, and led all communication efforts, from website to video. The integration of modelling, safety, and storytelling has already strengthened our role in the project. We're excited to keep translating computational insights into material decisions and to communicate those breakthroughs as they happen."

Voices from our consortium

CITEVE

"At CITEVE, we focus on making sustainable innovation viable at industrial scale. PENGUIN gave us access to novel fibres and challenged us to process them into yarns and functional fabrics. We've shown that's possible. Next, we'll optimise those fabrics, test durability and contribute to circularity assessments, ensuring these materials are not only sustainable, but also ready for the market."

ORGANOCLICK AB

"For us, PENGUIN is a natural match. It lets us apply our green chemistry expertise, hydrophobisation, bio-based binders, to next-generation, high-performance textiles. The first year gave us valuable validation: our chemistries worked on new fibres, and we identified critical process parameters. We're now looking forward to optimising product variants even further and scaling their application through feedback from real textile processing."

RINA

“At RINA, we are continuously engaged in research and development initiatives aimed at identifying more effective and value-added solutions to contribute to the achievement of sustainability goals. Within the PENGUIN project, RINA's role includes conducting comprehensive sustainability assessments under the Safe and Sustainable by Design framework, addressing environmental, economic, and social dimensions. Additionally, we are responsible for defining reuse and recycling strategies for the developed textiles and for formulating the project's exploitation strategy.”

Voices from our consortium

MOLINA

"MOLINA'score business is natural insulation materials, such as feathers and down. However, over the years, our loose-fill synthetic departments started to grow, due to apparel brands' requirements; for this type of insulations, we currently use mostly recycled polyester. With PENGUIN project our aim is to replace polyester with a natural-based, biodegradable, sustainable fiber, that can allow us and our customer brands to reduce CO2 footprint and lower the impact on the environment."

COLMAR

"As a technical sportswear brand, we're always looking for new materials that offer both performance and responsibility. PENGUIN gives us access to cutting-edge fibre and insulation innovations that could shape the jackets of tomorrow. During this first year, we supported testing and aligned development with real product requirements. Our next step: help turn the materials into functional, high-performance garment prototypes."

Voices from our consortium

Spinnova takes a pioneering role in producing innovative functional cellulose-based fibers, drawing on their extensive knowledge to push the boundaries of sustainable fiber technology. Their involvement extends to collaborating on the enhancement of fiber applications, demonstrating their commitment to textile innovation and sustainability

SPINNOVA

"At Pangaia Grado Zero, we are deeply committed to advancing sustainability in the textile industry, with a focus on reducing environmental impact and promoting responsible innovation. Through the PENGUIN project, we aim to build on our proven expertise in thermal comfort for outdoor applications, integrating advanced, eco-friendly materials into wearable solutions. The design of our urban-style prototype jacket will showcase the transformation of newly developed organic-based fibers, textiles, and insulation systems into user-focused garments that reflect our vision of a fully plastic-free textile future."

PANGAIA GRADO ZERO

PENGUIN

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