



THREADING-CO₂

PROJECT PRESENTATION

VALORISATION OF CO₂ WASTE STREAMS INTO POLYESTER FOR A SUSTAINABLE CIRCULAR TEXTILE INDUSTRY



The textile industry, one of the largest industries globally, is also one of the most polluting, contributing to 10% of global greenhouse gas emissions.

The THREADING-CO₂ project aims to address this challenge by **converting CO₂ waste streams into sustainable PET textiles.**

With the goal of achieving carbon neutrality and circularity, **the project plans to scale up its technology to produce commercially viable PET textile products using renewable energy sources.** By implementing this innovative approach,

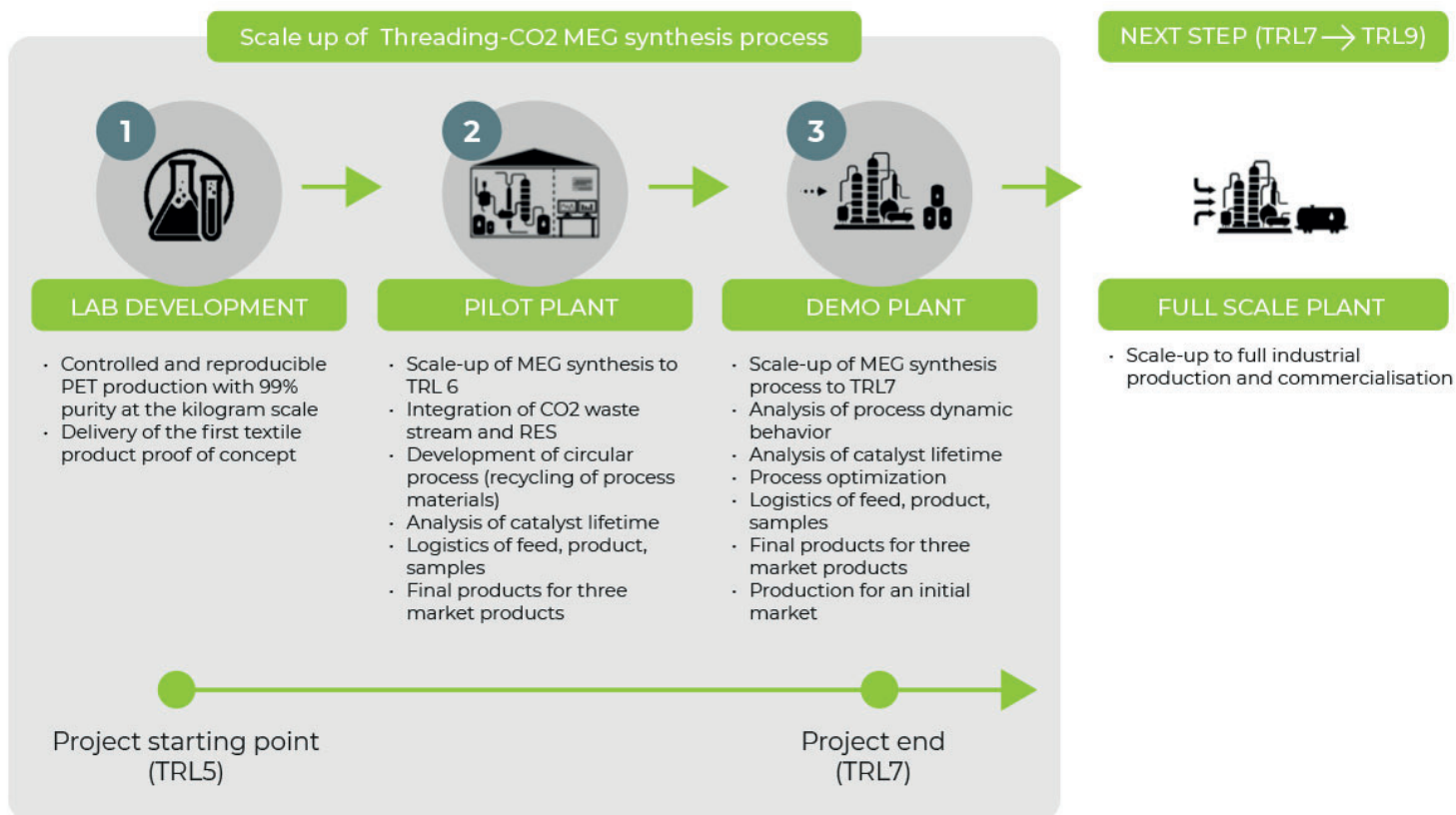


THREADING-CO₂ aims to reduce at least 7 million tons of CO₂ emissions by 2030, while also mitigating climate change impacts and avoiding negative effects associated with fossil fuel use. The project will create a European value chain for sustainable PET textiles and contribute to positive societal outcomes related to climate change mitigation.



Additionally, THREADING-CO₂ will develop learning resources and engage stakeholders to ensure market uptake and raise awareness about greener polyester textiles.

Through its demonstrations and assessments, the project aims to replace existing products, improve environmental footprints, and facilitate technology replication and scalability in other energy-intensive industries.



Kicked off on January 1st, 2023, the THREADING-CO₂ project addresses the call topic HORIZON-CL4-2022-TWINTRANSITION-01-11: Valorization of CO/CO₂ streams into added-value products of market interest (Processes4Planet Partnership) and **is brought forward by 13 partners from 7 EU countries, coordinated by FAIRBRICS.**





<https://fairbrics.co>

Fairbrics is the first company in the world to have demonstrated at lab scale a first-of-a-kind technology based on latest developments of catalytic chemistry that directly converts CO₂ waste streams into sustainable polyester fibers. Fairbrics proprietary process reduces dependence on expensive fossil fuels and decreases GHG emissions. In the THREADING-CO₂ Project, Fairbrics is leading the work to construct the Pilot line in Antwerp, Belgium with the objective to demonstrate the scalability of our technology in a circular manufacturing value chain. Fairbrics also takes care of the Project management activities.

ELCAT – UANTWERPEN



<https://www.elcat.be>

ELCAT's main expertise is related to the electrochemistry and development of electrochemical processes suitable for industrial applications. This encompasses three interconnected lines of research: electrochemical synthesis, electrocatalysis and electrochemical reactor engineering. Among major applications are the design of new reactor components in electrolyzers and fuel cells and "Power-to-X", i.e., using electricity for the sustainable production of chemicals. Within THREADING-CO₂, the role of ELCAT is to develop and up-scale the electrodes for the electrochemical conversion of CO₂ to CO and incorporate them into a working electrolyzer. ELCAT will investigate ways to deposit the catalysts fabricated and up scaled at Fairbrics in a reproducible and homogeneous manner onto large-scale gas diffusion electrode (up to 1 m²). In addition, it will also investigate the microfluidics to improve the multiphase transport inside the reactor such that it allows smooth and stable operation. Its final goal is then to assist in the design and construction of the pilot CO₂ electrolyzer.



FUNDACION TECNALIA RESEARCH & INNOVATION



TECNALIA is the largest center of applied research and technological development in Spain, a benchmark in Europe and a member of the Basque Research and Technology Alliance. TECNALIA collaborates with companies and institutions to improve their competitiveness, people's quality of life and achieve sustainable growth. The mission of TECNALIA is to transform technological research into prosperity and the vision to be agents of transformation of companies and society for their adaptation to the challenges of a changing future. TECNALIA is the first private Spanish organization in contracting, participation, and leadership in the European Commission's Horizon 2020 programme and is ranked third in European patent applications. The main scopes of action are smart manufacturing, digital transformation, energy transition, sustainable mobility, personalized health, urban ecosystem, and circular economy. TECNALIA will develop the sustainability assessment of THREADING-CO₂ technologies and product considering the environmental, economic, and social aspects. The whole value chain will be considered: The Carbon Capture processes, the transformation of CO₂ into polyester, the benefits compared to fossil PET and the end-of-life PET recycling process.

LUT University



LUT is an international science university that conducts strong academic research and provides higher education based on that research. We seek new solutions for life-giving resources, clean energy, water and air with our expertise in technology, business and social sciences. We help society and businesses in their sustainable renewal. Our international community consists of 7500 members. Our campuses are in Lappeenranta and Lahti, Finland. We are the world's ninth best university for climate action. In the frame of THREADING-CO₂ LUT will help in the development of skills and competences related to the valorization of CO₂ through the co-development of learning and training resources for professionals and students. Co-design and develop modular THREADING-CO₂ academy peer learning programs to deliver tailor-made training modules to upskill and reskill employees in the process industries. We will co-develop modular learning resources on 'CO₂ valorization' for young professionals, university students, local and regional authorities/stakeholders and decision-makers.

AIMPLAS – ASOCIACION DE INVESTIGACION DE MATERIALES PLASTICOS Y CONEXAS



AIMPLAS, Technological Institute of Plastics located in Valencia, is a private, non-profit. Association with more than 750 associated companies. AIMPLAS is formed by +200 highly skilled professionals working on fields related to technological research and development on thermoplastic and thermosetting materials from TRL3 up to TRL7. AIMPLAS has a broad expertise in the fields of mechanical, chemical, thermal and enzymatic recycling, compatibilization, reactive extrusion, synthesis of biopolymers and renewable source materials, special assisted processing technologies, plastronics, materials for 3D printing, high performance coatings, polymer nanocomposites, functionalization of nanoparticles, gases capture and use, catalyzers, multilayer structures and development of plastic products for a broad range of industrial sectors, gained in the frame of EU and Spanish projects. Since year 2000, AIMPLAS has participated in more than 140 EC funded projects (FP5, FP6, FP7, LIFE+, EcoInnov, sudoe, H2020 & HEU), among others, coordinating several of them. AIMPLAS has state-of-the-art 12,000 m² facilities, including more than 35 thermoplastics and thermoset pilot plants, analysis, and testing laboratories (physical-mechanical, chemical, packaging, automotive and construction) and training areas. These pilot lines and laboratories are used by many customers every year allowing them to test new materials, optimize production processes and launch new products to the market, supported by AIMPLAS technical staff, resulting in assays, technical assessments, and training actions to + 2,800 clients per year. AIMPLAS is involved in the upstream phase and process development including engineering design, supply and development of green catalyst and solvents, development of the electrolyser, and the chemical reuse & recycling, bringing a circular dimension. AIMPLAS will perform the catalyst scale-up in the continuous large size reactor including optimization of the preparation methodology and catalyst production.



CiaoTech – PNO Group



<https://www.pnoconsultants.com/it>

The **PNO Group** (aka PNO Consultants), established in 1984, is a European group, made up of a pool of more than 400 professionals across 9 Member States. Every year, PNO supports more than 3.000 clients in their R&D processes, realizing original data-driven and expert-driven analysis and creating over 300 cutting-edge R&D projects – changing the world for the better. PNO has drafted and successfully executed dissemination and exploitation plans of a great number of European projects in various sectors. In this project, PNO is represented by CIAOTECH S.r.l., the Italian branch of PNO Consultants, specialized in R&D Advisory, Innovation Management and funding procurement, providing consultancy services to private and public organizations. CIAOTECH is the leader of Work Package 6, Dissemination, Communication and Exploitation of the project results and outputs.

DEUTSCHE INSTITUTE FÜR TEXTIL – UND FASERFORSCHUNG DENKENDORF



<https://www.ditf.de/en/index/ditf.html>

The **German Institutes of Textile and Fiber Research Denkendorf** (DITF), located in south-western Germany (state of Baden-Württemberg), with its 250 employees and 25.000 m² of research area develop, research, investigate and innovate on any aspect of the entire textile value chain. This includes for example polymer synthesis, fiber spinning applying any technology, carbon, cellulose and ceramic fiber production, fiber composites, smart textiles, medical applications, and adaptive processes to name just a few. For our application-orientated research we cooperate with industrial partners as well as with experts and research from other institutes and universities around the world. The objectives of the DITF within THREADING-CO₂ is to prove polymerizability of the ethandiol (produced from CO₂) to PET. Therefore, an adjustment of common reaction conditions like catalyst and its loading, reaction parameters as temperature and duration, pressure and other parameters might be necessary. Soon as a certain viscosity is achieved during the reaction the molten polymer will be solidified and granulated. If necessary solid-state polymerization allows to increase and adjust the molecular weight. The molecular weight in turn strongly affects the spinnability of the recycled PET and thus the properties of the subsequently produced fibers. On semi-industrial fiber production plants, the

filament development including drawing and texturizing will prove the quality and homogeneity of the polymer. Successful results can be transferred to industrial production plants in short term.

LAPPEENRANNAN KAUPUNKI



Finland



<https://www.greenreality.fi/en>
<https://www.lappeenranta.fi/en>

The city of **Lappeenranta** is in the south Karelia of Finland, and it is a border town with Russia. It has 73 thousand inhabitants. The city was declared the climate capital of Finland and in 2021, it was awarded the EU Green Leaf Award for its efforts and actions toward climate neutrality. In 2022, the city was selected among the 100 NetZero Cities initiative, joined the Driving Urban Transition initiative, and joined the Urban Transition Mission, a global cities network toward achieving ambitious climate and energy goals. The city is ambitiously committed to sustainable urban development, which is promoted in the frames of the city's brand Greenreality, that is ecological thinking, knowledge, responsible choices and, above all, actions towards a sustainable tomorrow. We build the future together with citizens, communities, and companies. In THREADING-CO₂-project, the city of Lappeenranta collaborates in WP5- Development of modular learning resources leaded by the Lappeenranta–Lahti University of Technology. The main activities include supporting building up and piloting educational package, for example organizing workshops for reuse of CO₂ to the local stakeholders, dissemination and communication, validation of training program and piloting it in South Karelia, Finland.

DIGI TOUCH OU



Digiotouch



Estonia



<https://digiotouch.com>

Digiotouch (DIGI) is a fast-growing deep tech SME providing secure, sustainable Digital Transformation products and services to European industries. DIGI operates in four industry verticals - Digital Healthcare & Robotics, Agri-food & Circular Economy, Smart Manufacturing (Industry 4.0/5.0), and Cybersecurity & Data Privacy. Its core competence is digitalising legacy business processes, operations, and assets using two core products - Cloud based, secure Paradise Platform and Digiotouch Edge.

Cybersecurity, Data Privacy, and Trust are natively built into the products and services. The platforms broadly support AI, Blockchain, Extended Reality (XR), and IoT technologies. The ground-breaking industrial research & innovation activities of the company has received funding from 4 Horizon Europe and 25 Horizon 2020 projects. The company also graduated from the EIT Health Living Labs and Test Beds Programme 2019 to validate its business model and scale-up strategies for a healthcare mobile app. DIGI has been one of the winners of the EU Datathon 2018 competition. DIGI leads a task on identifying skill gaps in the THREADING-CO₂ target groups regarding CO₂ valorization and recycling. It will co-design and co-develop modular learning resources and training materials on 'CO₂ valorization' for young professionals, university students, local and regional authorities/stakeholders.

FAURECIA



FORVIA comprises the complementary technology and industrial strengths of Faurecia and HELLA. With over 290 industrial sites and 76 R&D centers, 157,000 people, including more than 15,000 R&D engineers across 40+ countries, FORVIA provides a unique and comprehensive approach to the automotive challenges of today and tomorrow. Composed of 6 business groups and a strong IP portfolio of over 14,000 patents, FORVIA is focused on becoming the preferred innovation and integration partner for OEMS worldwide. FORVIA aims to be a change maker committed to foreseeing and making the mobility transformation happen. Faurecia, the parent company of the FORVIA Group, is a global automotive technology leader. In 2022, the Group reported consolidated sales of €25.5 billion. Faurecia is listed on the Euronext Paris market and is a component of the CAC Next 20, CAC 40 ESG and CAC SBT 1.5° indexes.

Faurecia role within this ambitious four-year project is to produce, test & validate the sustainable PET textile automotive product out of the CO₂ recycled polyester fibers / yarns processed by DITF partner. Demonstration will be conducted twice at pilot and industrial scale to confirm the scale-up of the technology. Focused on sustainability, this approach is also reducing the carbon footprint of seating inspired by circularity.

NALDEO TECHNOLOGIES & INDUSTRIES



France



<https://naldeo-technologies-industries.com>

Naldeo Technologies and Industries (Nal) is an engineering and consulting firm specialized in environmental transition. Nal is composed of four different activities:

- Risk Management
- Industrial Performance
- Energy & Digital
- Innovation & Consulting (I&C)

For the THREADING-CO₂ project, it's I&C that will have the biggest implication. Our innovation and consulting team offers services in:

- Technology consulting (Due Diligence, Technical audits, Decarbonization strategies)
- Innovative process engineering (Functional Analysis – Value Analysis, Preliminary Design, Detailed design & turnkey pilot projects)
- Support to start-ups in industrializing their innovations.
- The Main part of our contribution on the project will be on the WP1 WP2.
- WP1: Detailed design for stable and efficient continuous production of 2 kg/h MEG
- WP2: Scale up of the pilot line developed in WP1 to a 20 kg/h MEG production

THX SUREPURE BV



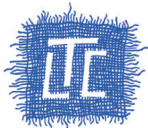
Belgium



<https://triplehelixgroup.com>

Triple Helix Molecules as a Service is an independent venture studio that systematically attracts capital to create, build and run new, ecosystem-based initiatives that help close material loops and preserve molecules for reuse. As a first initiative, we are building SurePure, a PU and PET recycling plant on the Port of Antwerp-Bruges' NextGen District. On a 6ha site we will chemically convert over 30kt of PU foam and PET into virgin quality polyols and amines. SURE main task in this project is to provide purified CO₂ to the pilot plant.

LES TISSAGES DE CHARLIEU



<https://www.tissagesdecharlieu.fr>

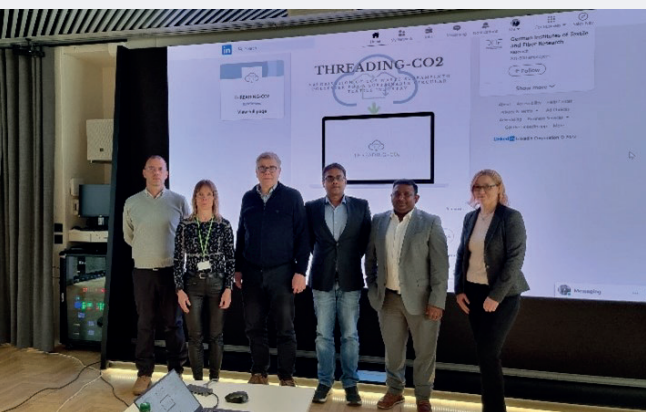
LES TISSAGES DE CHARLIEU is an industrial weaver strong with 120 years of expertise. We create and manufacture exclusive fabrics and textile products in France. Les Tissages de Charlieu brings together more than 115 employees serving a range of products that are mostly made of recycled materials, have a low carbon footprint and are locally manufactured. Our products are tailor-made for the clothing, furniture, and packaging industries. Les Tissages de Charlieu also offers the services of its low-carbon textiles design office to spur the circular transition within the textile industry and beyond (e. g. LCAs, ecodesign, deadstock and post-consumer sorting and recycling for circularity...). As a weaving factory, our role in THREADING-CO₂ goes from sharing technical specifications regarding polyester yarns to be developed to weaving these yarns into 100% recycled polyester fabrics. Partner roles within the THREADING-CO₂ project can be grouped into six main activities. The upstream phase and process development, with NALDEO, Triple Helix Molecules, AIMPLAS and University of Antwerpen, will include CO₂ supply, engineering design, supply and development of green catalyst and solvents, development of the electrolyser, and the chemical reuse & recycling, bringing a circular dimension to the project. THREADING-CO₂ core activities will be led by the coordinator, FAIRBRICS, dedicated to the scale up from lab scale to pilot line and then a demonstration scale at the project end. The final product will be tested by the German Institutes of Textile and Fiber Research Denkendorf and industrial end users FORVIA-Fauracia and Les Tissages De Charlieu. Learning resources design will be split between LUT University, Digiotouch and Lappeenranta. The full LCSA of the project will be performed by TECNALIA and the dissemination, communication, and exploitation activities by CiaoTech.



UPDATES FROM THE CONSORTIUM!

Scale-up of MEG production process and set-up of pre-industrial pilot line (TRL6)

ELCAT – UAntwerpen is the responsible partner for this work package, and significant progress has been made in the first couple of months towards obtaining the work package milestones and deliverables. Three tasks are currently ongoing and on track and cover the fields from catalyst design, development and recycling to simulation and optimization of an overall design for continuous MEG production including the safety aspects. Preliminary tests with a first prototype reactor were performed and a first category of catalysts has been prepared.



Development of Modular Learning Resources

THREADING-CO₂ WP5 team from DIGI TOUCH had a face-to-face meeting hosted by the city of Lappeenranta in Finland to discuss skills and competences related to the valorization of CO₂ and stakeholder analysis.

Dissemination, Communication and Exploitation

CiaoTech – Gruppo PNO, the partner responsible for this work package, has made substantial progress during the initial months of project implementation!

The Dissemination and Communication strategy has been developed and planned, and all the materials supporting THREADING-CO₂ D&C are now available. In terms of Exploitation, the team is currently focused on mapping the research and innovation ecosystem, value chain, and key stakeholders related to the project. This crucial step sets the foundation for performing a detailed market analysis, identifying technological trends, key players, market barriers, and drivers for THREADING-CO₂.



THREADING-CO₂

**Stay tuned for more updates
and follow us
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CONSORTIUM



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