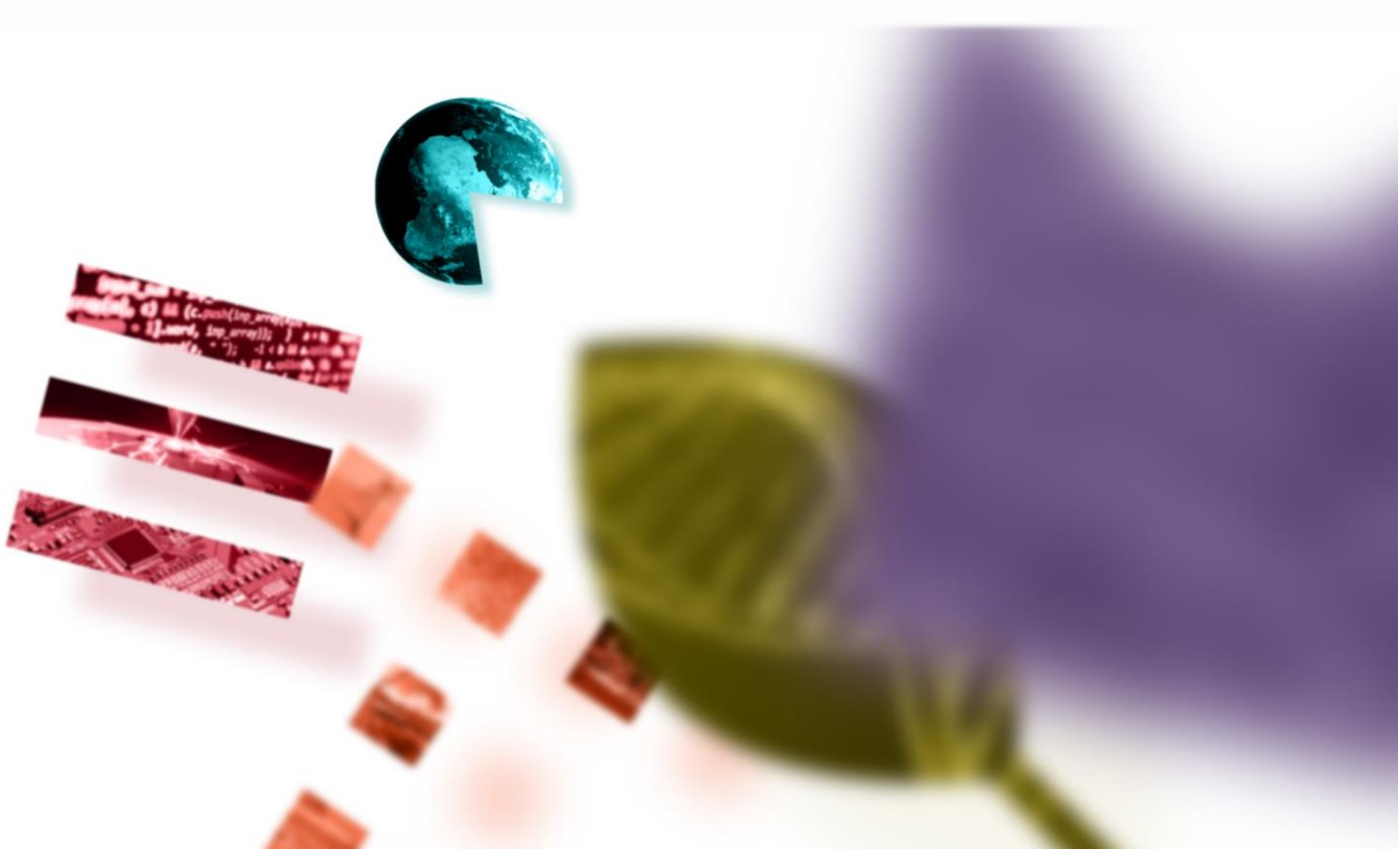
Technological Centre

Capabilities Horizon Europe

CIRCULAR BIO-BASED EUROPE 2023

CONTENT



HORIZON-JU-CBE-2023-IA-01: Small scale biorefining in rural areas

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	7.5 M€	15 M€	2	IA

Demonstration, upscaling and validation of resource-efficient technologies for the treatment of available resources (underutilised biomass; by-products; residues; solid, liquid and gaseous waste and residual streams).

Research and development of small-scale decentralized biorefinery processes based in a wide range of technologies:

- Bacterial, enzymatic and other biocatalytic processes that admit as a feedstock a range of materials, including rural resources (e.g., gaseous waste such as CO_2, milk processing subproducts and effluents, manure, vinery subproducts and effluents, agri-food streams, wastewater, mining residues…) for the production of chemical building blocks (C5, C6, sugars, volatile organic acids etc.) and other valuable products such as biopolymers, proteins, metals, biooils….
- Biological. physiochemical and thermal technologies for the recovery of valuable compounds from vegetable biomass and residual currents: polyphenols, tannins, carbohydrates, biochar, biooils…

Assess the environmental (including elimination / reduction of pollution from the processing operations) and socio-economic performance of the demonstrated value chains.

Sustainability Assessment of processes and outputs comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

HORIZON-JU-CBE-2023-IA-02: Production of safe, sustainable, and efficient bio-based fertilisers to improve soil health and quality

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	7.5 M€	15 M€	2	IA

Technical validation and implementation of bio-based fertilizers from nutrient-rich waste and side streams (such as agricultural/forest/aquatic residues and wastes, municipal waste, food waste, sludge, etc.), thereby reducing the environmental impact linked to the dispersion of nutrients.

Research and technological development at lab and pilot scale of several bioprocesses (based on enzymes, bacteria, fungi, etc.) for the obtention of fertilizers from a wide range of waste streams that could include: agricultural waste, organic phase of municipal waste, sludge from wastewater treatment plants, etc.

Study and validation of the performance of fertilizers at lab scale (including growth tests in pots and physiochemical and toxicity characterizations of the fertilizer products) and pilot scale.

Development and validation of coatings or other delivery system for active substances in fertilisers:

Development of lignocellulosic materials to be used as biodegradable delivery systems based on nanocellulose and lignin formulations.

Research on new controlled-release fertilizers based on polyhydroxyalkanoate (PHA) encapsulation, replacing non-biodegradable and harmful coatings such urea-formaldehyde, synthetic polymers. PHA is a biodegradable biopolymer produced by microorganisms, and could be produced from agriculture-residues, closing the loop between fertilizing and crop production. CETIM could work on the development of PHA-coated fertilizers, testing the release of different types of nutrients (NPK) over time, and addressing cultivation tests in grow chamber.

R&D of new slow-controlled release fertilizers based in engineered biochar, through processes of co-pyrolysis of biomass combined with other fertilizers and nutrient-rich wastes (e.g., manure, poultry litter, etc.) reducing nutrient loss and improving nutrient uptake of crops, and metal immobilization in soil.

Research and development on natural adsorbent-based fertilizers with slow release, able to selectively recover nitrogen and phosphorus compounds from wastewater and other water currents. The N-P-loaded adsorbent materials can be directly applied to the land as controlled release fertilizers, significantly improving the efficiency and environmental footprint in comparison with conventional fertilizers.***Optimise the costs of the value chain (including logistics) and circular approaches of waste and side streams and increase resource efficiency of the fertiliser production.***

Use of blockchain technologies to ensure the certification process and guarantee the origin of the materials.

HORIZON-JU-CBE-2023-IA-03: Improve fermentation processes (including downstream purification) to final bio-based products

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	6 M€	15 M€	2	IA

Development and optimization of fermentation processes for several feedstocks

R&D of bacterial, enzymatic and other biocatalytic processes that admit as a feedstock a wide range of materials for the production of bio-based products (C5, C6, sugars, volatile fatty acids, biopolymers…).

R&D of identification and selection of microorganisms (including screening of environmental populations), characterization, bioaugmentation strategies, etc. R&D of improvement of microorganism populations in order to obtain higher yields, selectivity and biological reaction rates

R&D of membrane (e.g., forward osmosis with biomimetic membranes, selective nanofiltration…) and green solvent (e.g., ionic liquids) downstream concentration and purification processes to improve selectivity, resource efficiency and energy efficiency. Membrane selection and testing at lab and pilot scale. Design, synthesis and testing of innovative solvents.

Application of the Safe and Sustainably by Design Framework

Implementation of eco-design and Safe & Sustainable-by-design strategies to bioactive materials, chemicals, and processes. Health, Safety and Risk assessment of novel processes and materials.

Sustainability Assessment of processes and products comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

Assessment of biodegradability (water, soil, compost…) and recyclability tests to assess sustainability and safety of novel product's end-of-life.

HORIZON-JU-CBE-2023-IA-04: Recycling bio-based plastics increasing sorting and recycled content (upcycling)

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	6 M€	15 M€	2	IA

Develop, upscale and deploy innovative recycling technologies or adapt, optimise and deploy existing ones for bio-based plastics

Reconditioning of thermoplastic materials wastes. They can be optimized prior to extrusion by the use of a washing-dryer machine and cutting mill. This way, washed, dried and milled plastic can be used in order to study how different parameters in the reconditioning process can affect the quality of the recycled thermoplastic

Development of new biobased thermoplastic (mainly based on PLA and PHB) composites using recycled biomatrixes, biofillers and bioadditives obtained from renewable and/or recycled sources. Different moulding methodologies for polymeric formulations (extrusion, injection, 3D printing ...) could be implemented.

R&D of innovative biological (bacterial, fungal and enzyme-based) processes for plastic recycling. Selection, improvement and characterization of populations of microorganisms. Screening of microorganisms from environmental samples. Biodegradation tests at lab and pilot scale and assessment of the integration with current waste management practices.

R&D of thermochemical processes for plastic recycling. Study and optimization of the conditions for the obtention of different valuable products (e.g., building blocks).

Application of the Safe and Sustainably by Design Framework

Implementation of eco-design and Safe & Sustainable-by-design strategies to bioactive materials, chemicals, and processes. Health, Safety and Risk assessment of novel processes and materials.

Sustainability Assessment of processes and products comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

Assessment of biodegradability (water, soil, compost…) and recyclability tests to assess sustainability and safety of novel product's end-of-life.

HORIZON-JU-CBE-2023-IA-05: Development of scalable, safe bio-based surfactants, with an improved sustainability profile

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	6 M€	15 M€	2	IA

Bio-based surfactants from a wide range of lignin fractions

Bio-based surfactants development from lignin fraction. Technical approaches could include isolation of active phases and the chemical functionalisation of lignin and/or micro/nano lignin of different types such as Kraft, alkaline, lignosulphonate, etc.

R&D of the obtention of biobased surfactants (e.g., rhamnolipids, surfactin…) from microorganisms (bacteria, fungi, yeast), more eco-friendly, less toxic and with higher stability in varying conditions. Study and selection of populations and optimization of the process.

Application of the Safe and Sustainably by Design Framework

Implementation of eco-design and Safe & Sustainable-by-design strategies to bioactive materials, chemicals, and processes. Health, Safety and Risk assessment of novel processes and materials.

Sustainability Assessment of processes and products comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

Assessment of biodegradability (water, soil, compost…) and recyclability tests to assess sustainability and safety of novel product's end-of-life.

HORIZON-JU-CBE-2023-IA-06: Selective, sustainable production routes towards bio-based alternatives to fossil-based chemical building blocks

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	6 M€	15 M€	2	IA

Lignocellulosic biorefinery as a feedstock

Production of an extensive portfolio of bio-based platform chemicals from all the lignocellulosic fractions by physical, mechanical, chemical and enzymatic processes. CETIM has several solutions to substitute the harmful and non-sustainable chemicals involved in the processes to produce bio-based chemicals.

Experience in lignocellulosic fractionation, obtention of hemicellulose products (sugars), cellulose fibres, nanocellulose, micro/nano lignin, aromatic building blocks from lignin and derivatives.

Propose and deduce reaction mechanisms and pathways to produce the studied bio based platform chemicals; enabling reaction kinetics elucidation and mechanistic understanding. This should be provided also in the context of further advancing process scale-up;

The processes used depend on the feedstock choosen and include:

- For Lignin: oxyalkylation, amination, sulfomethylation, glyoxalation (with biobased dialdehyde), epoxidation, electrochemical oxidation to obtain: polymeric matrices, vanillin, polymeric and concrete additives (antimicrobial, antifungal, plasticisers, antioxidants, UV-blocking…). Micro lignin particles as filler/microcapsules of different substrates by mechanical processes.
- For Cellulose: acid hydrolysis to obtain levulinic acid, levulinic esters, DALA, MTHF, diphenolic acid or levulinic acid-derived ketal to obtain substitute for bisphenol A in epoxy resins, precursor of acrylic

acid for application in acrylic resins, pesticides, cetane improvers and colf-flow performers for diesel, additives for food…. Enzymatic and mechanical treatments to obtain cellulose nanofibers and additives (hydrophobic and antimicrobial).

- For Hemicellulose: homogeneous catalyses to obtain furfural/furfuryl alcohol
- For Thermoplastic matrixes: polyurethane, epoxy and acrylic resins from chemical modification of vegetable oils throughout epoxidation, hydroxylation, acetylation and carbonation reactions.
- For agro-industrial waste and residual streams: bacterial, enzymatic and other biocatalytic proceses for the production of a wide range of chemical building blocks (C5, C6, sugars, volatile organic acids, PHA/PHB, etc.)
- R&D of enzyme, chemical and thermal pretreatments of different agro-industrial waste and residual streams, optimizing their subsequent conversion into building blocks.
- R&D of membrane (e.g., forward osmosis with biomimetic membranes, selective nanofiltration…) and green solvent (e.g., ionic liquids) downstream concentration and purification processes to improve selectivity, resource efficiency and energy efficiency. Membrane selection and testing at lab and pilot scale. Design, synthesis and testing of innovative solvents.

Application of the Safe and Sustainably by Design Framework

Implementation of eco-design and Safe & Sustainable-by-design strategies to bioactive materials, chemicals, and processes. Health, Safety and Risk assessment of novel processes and materials.

Sustainability Assessment of processes and products comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

Assessment of biodegradability (water, soil, compost…) and recyclability tests to assess sustainability and safety of novel product's end-of-life.

HORIZON-JU-CBE-2023-IA-07: High performance, circular-by design, bio-based composites

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	6 M€	15 M€	2	IA

Production of composites from bio-based materials

Strategies could include:

- **Mechanical/physical/chemical treatments** to obtain micro/nanoparticles from cellulose and lignin, to be used as fillers.
- **Chemical modification of lignin by means** oxyalkylation, oxypropylation, epoxidation, amination, etc., to be used as matrix.
- **Antimicrobial and fire-retardant additives from modified lignin** and cellulose by cationisation, phosphorylation, amination, etc.
- Bio-based chemical/synthesis of polymeric precursors obtained from vegetable/residual oils could be developed and applied. **Biobased thermoset composites** through the use of biomatrixes, biofillers and bioadditives from renewable sources could be obtained: polyurethane, epoxy and acrylic resins

from chemical modification of vegetable oils throughout epoxidation, hydroxylation, actylation and carbonation reactions.

- Obtaining **biobased thermoplastic and thermoset composites** through the use of biomatrixes, biofillers and bioadditives from renewable sources. Extrusion, Injection and 3D printing could be employed.
- Development of eco-sustainable super hydrophobic, icephobic, anti-corrosion / abrasion, antimicrobial, **reinforced coatings, and their application** methodologies on different substrates. Formulations related to photocatalytic and biobased polyurethane and acrylic coatings derived fully or partially from lignin or vegetable oils has also formed part of the CETIM´s expertise.
- Design and characterisation of new eco-friendly thermal insulation materials by using lignin or carbonated oils as alternative to petroleum-based polyols.
- Epoxy bio-based resins for construction purposes through the incorporation of epoxidised oil and lignin to partially replace the harmful substances such as epichlorohydrin and bisphenol A di-glycidyl ether.

Application of the Safe and Sustainably by Design Framework

- Implementation of eco-design and Safe & Sustainable-by-design strategies to bioactive materials, chemicals, and processes. Health, Safety and Risk assessment of novel processes and materials.
- Sustainability Assessment of processes and products comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.
- Assessment of biodegradability (water, soil, compost…) and recyclability tests to assess sustainability and safety of novel product's end-of-life.

HORIZON-JU-CBE-2023-R-01: Phyto-management; curing soil with industrial crops, utilising contaminated and saline land for industrial crop production

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	5 M€	10 M€	2	RIA

Soil bioremediation and restoration of affected lands contaminated by heavy metals and organic/inorganic pollutants enhancing the development of crops.

Development of technosols with different formulations, selection of species of fungi to develop a la carte mycotechnosoils. Valorisation of organic pollutants for the obtention of fertilizers.

R&D of bioremediation, phyto-remediation and electrobioremediation of heavy metals, organic compounds, microplastics, and other pollutants. Lab-scale (pot) testing of crops for phytoremediation, including complete characterization of the crops (e.g., content in metals, organics…). R&D of bioaugmentation tools (screening, selection and characterization of specific microbial populations) to enhance the performance of remediation.

Valorisation and conversion of biomass and recovered compounds for high-value applications.

Methodologies for extraction and bioprocessing of different sources of lignocellulosic and non-lignocellulosic materials from crops including enzymatic treatment, pre-treatment, organosolv extraction with green solvents. Fractionation of cellulose, lignin and hemicellulose currents. Obtention of chemical building blocks

Bioleaching for the recovery of interesting metals from vegetal species with capability to retain metals (Cr, Co, Mn, Fe, Zn, Cu, etc.).

Life Cycle Environmental Assessments to ensure the minimisation of environmental impacts in the context of good agricultural practices, sanitary and other safety related implications.

Sustainability Assessment of processes and outputs comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

HORIZON-JU-CBE-2023-R-02: Optimised forest-based value chains for high value applications and improved forest management

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	5 M€	10 M€	2	RIA

Early intervention actions to restore and enhance forest health.

Research and development of technosols with different formulations, selection of species of fungi to develop a la carte mycotechnosoils adapted to the local species.

Development of growth-promoting substances by biological processes (fungal, bacteria or enzyme-based) using organic wastes as substrates.

Innovative solutions (pre)treatments to obtain forest products from the valorisation of different starting materials including different grades of woody feedstocks.

Research in new processes for the extraction via organosolv and/or enzymatic technologies of the cellulosic, lignin and hemicellulosic fractions from different woody feedstock. Green chemistry routes (aqueous media reactions, catalysed -low energy consumption- processes, etc.) for the obtention of high-added value chemical building blocks as an alternative to fossil-based chemical counterparts.

Life Cycle Environmental Assessment conducted to understand the environmental impact of the proposed solutions, consider in particular the biodiversity enhancement and resource efficiency potentials. **Social impact assessment to understand the impact on rural actors.**

Sustainability Assessment of processes and outputs comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

HORIZON-JU-CBE-2023-R-03: Robust and optimised industrial biotech and chemical/industrial biotech processes

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	5 M€	10 M€	2	RIA

Incorporate reactor design (e.g. membrane reactors, small-scale reactors, microfluidics), process design, process control and optimisation as well as catalysis optimisation aspects that are relevant to also enable tandem chemical/biotech processes, and where applicable for optimisation of continuous production approaches (batch2continuous)

Testing and optimisation of microbial, enzymatic and catalytic processes at lab and pilot scale. Integration of process in bio-reactors.

Research, design and development of pre-treatments and biotechnological and chemical processes at laboratory level and semi-pilot and pilot scales. R&D of improvement and optimisation of biocatalysts in order to obtain higher yields, selectivity and biological reaction rates. Study of selection of microorganisms (including screening of environmental populations), characterization, bioaugmentation strategies, etc.

R&D of the introduction of biological processes (mainly enzymatic) into industrial chemical processes to reduce carbon footprint, energy consumption and improve overall process efficiency.

R&D of membrane downstream concentration and purification processes (e.g., forward osmosis with biomimetic membranes, selective nanofiltration, electrodialysis…) to improve selectivity, resource efficiency and energy efficiency. Membrane selection and testing at lab and pilot scale.

R&D of innovative and greener solvents (e.g., ionic liquids) for improved (selectivity, efficiency…) downstream purification. Design, synthesis and testing of the innovative solvents.

Ensure and assess productivity, yield, robustness, flexibility of the process.

Sustainability Assessment of processes and outputs comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.

HORIZON-JU-CBE-2023-R-04: Development of novel, high-performance bio-based polymers and co-polymers

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
20/09/2023	5 M€	10 M€	2	RIA

Polymer formulations with bio-based monomers improving the properties of original polymers

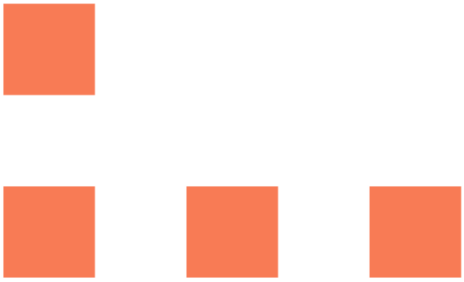
Development of new thermoplastic and thermoset polymeric formulations of bio-based origin (lignocellulosic materials, natural oils, etc.) by the use of green chemistry and/or enzymathic processes avoiding the use of substances of concern.

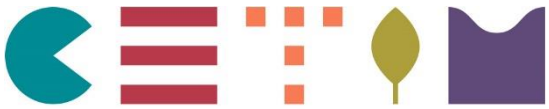
Pilot scale tests in extrusion of polymers

Design and production of polymeric compounds in pellet and film formats.

Assessment of the safety, circularity and overall sustainability of the developed polymers in view of the subsequent scale-up phase. Life cycle cost analysis for the techno-economic feasibility.

Sustainability Assessment of processes and outputs comprising the three pillars involved (environmental, economic, and social); Life Cycle Assessment (LCA), Life Cycle Costing Assessment (LCC) and Social Life Cycle Assessment.





CETIM Technological Centre

Parque Empresarial de Alvedro, calle H, 20.
15180 Culleredo, A Coruña, Spain

+34 881 105 624 | info@cetim.es | www.cetim.es