



CO₂SMOS - Advanced chemicals production from biogenic CO₂ emissions for circular bio-based industries

CO₂SMOS Project overview

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Biomethaverse workshop


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The CO₂SMOS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000790

Introduction

 **Issue:** Generation of > 506.7 Mt/y biogenic CO₂ in Europe from different green sources (e.g., biogas, fermentation processes, solid biomass combustion)

 **Motivation:** Recycling/conversion of biogenic CO₂ into long-life sustainable chemicals, or bioproducts in general, is of strategic importance for the future of EU BBIs

 **Solution:** Development of a set of novel and cost-competitive biotechnological & intensified chemical conversion processes to convert the industrial biogenic CO₂ & renewable energy sources (green H₂ and biomass) into added-value chemicals.

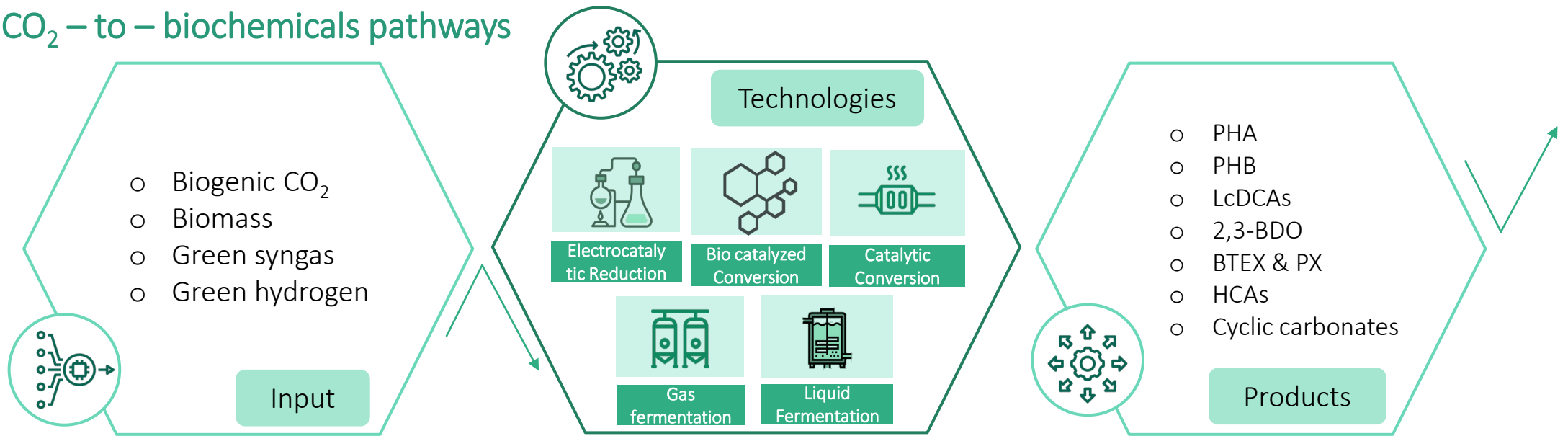


The project counts on the wide expertise and high interdisciplinarity of 15 international partners, including:

- Technology developers
- Industrial end-users;
- Interdisciplinary research institutions;
- Service providers &
- Knowledge hubs

CO₂SMOS Concept

Biogenic CO₂ – to – biochemicals pathways



CO₂SMOS targets

5 Conversion technologies

7 Bio-based chemicals

60% CO₂ emissions reduction

40% Production cost reduction

CO₂SMOS technologies target at **negative emissions** through the evaluation of:

- **Neutral CO₂**: biogenic CO₂ used as feedstock
- **Negative CO₂**: emissions avoided using RES & from CCU
- **Positive CO₂**: indirect emissions.

CO₂SMOS expected results



Environmental targets

Long-term CCU;
Zero or Negative CO₂ emissions;
Renewable materials & energy sources.

01



Economic targets

Cost-competitive conversion;
Replicable design;
New **business models**;
Diversification of economic base of BBI.

02



Technical targets

Flexible technologies;
High **energy efficiency**;
Scalable system;
TRL from 3 to 5.

03



Synergies promotion

Creation of **new marketplace** of CO₂SMOS value chains to promote **synergies** between the **interested BBIs**.

04



Replication promotion

Provide lessons learnt & recommendations for further application of CO₂SMOS concept to potential end-users.

05

CO₂SMOS Industrial Symbiosis Platform

CO₂SMOS targets at the **creation of new marketplace** for CO₂SMOS value chains to promote **synergies** between the **interested BBIS**. The developed Industrial platform is designed for BBIs to determine the **benefits of biochemicals production** from a **CE perspective**.

What is the added value of CO₂SMOS Platform?

- Offers a comprehensive framework for exploring and optimizing value chains;
- Users can leverage interactive graphs to explore and compare environmental and economic indicators in real-time, enabling informed decision-making.

What are the steps for the integration & creation of the CO₂SMOS Platform?

- The development of a methodology for environmental & economic assessment of CO₂SMOS concept based on the life cycle thinking;
- Followed by the development of a hybrid AHP-TOPSIS MCDA methodology to improve sustainability of CO₂SMOS conversion routes.

This online platform is part of the [CO₂SMOS](#) project, and it is designed to promote synergies between the interested bio-based industries (BBIs) by creating a new marketplace for the investigated value chains.

1	Biogenic CO ₂	→ Acetate	→ PHA	+
2	Biogenic CO ₂	→ Acetate	→ PHB	+
3	Biogenic CO ₂	→ Acetate	→ LcDCA	+
4	Biogenic CO ₂	→ Acetate	→ 2,3 BDO	+
5	Biogenic CO ₂	→ Syngas	→ 2,3 BDO	+
6	Biogenic CO ₂	→ Syngas	→ BTEX	+
7	Biogenic CO ₂	→	Cyclic Carbonate	+

CO₂SMOS Platform: Demonstration of LCA module

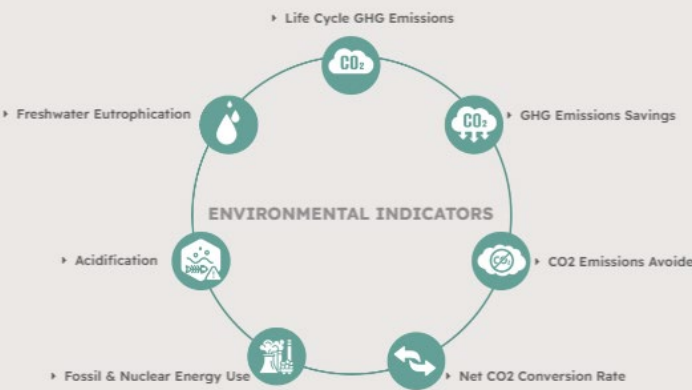
Life Cycle Assessment (LCA)

WHAT IS LCA?

Life Cycle Assessment (LCA) is a comprehensive methodology that evaluates the environmental impact of a product or service throughout its entire life cycle - from raw material extraction and production to use, maintenance, and end-of-life disposal or recycling.

WHY LCA MATTERS?

Understanding the environmental implications of our actions is essential for making informed decisions. LCA empowers us to identify areas for improvement, implement sustainable practices, and continually enhance our commitment to the planet.



The diagram shows a circular flow of environmental indicators around a central hub labeled "ENVIRONMENTAL INDICATORS". The indicators are:

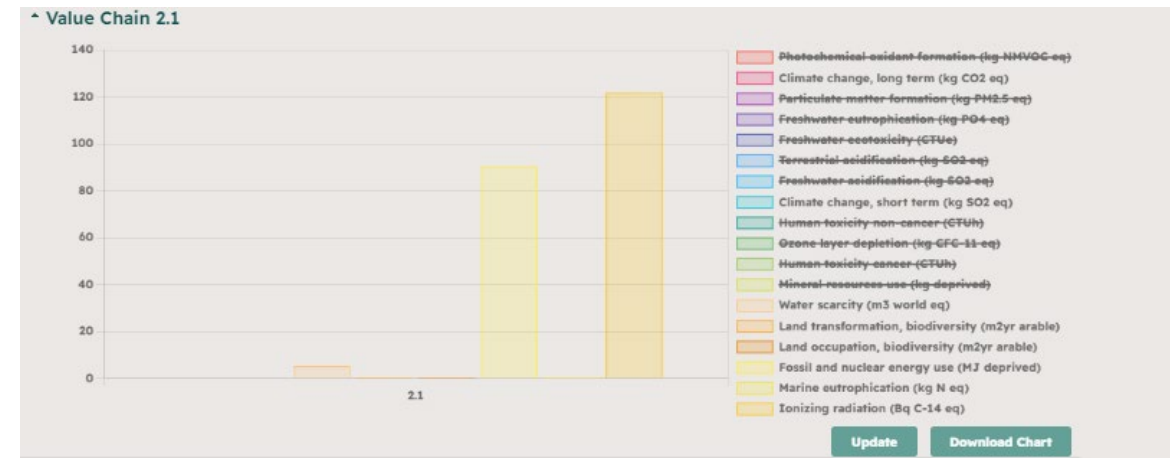
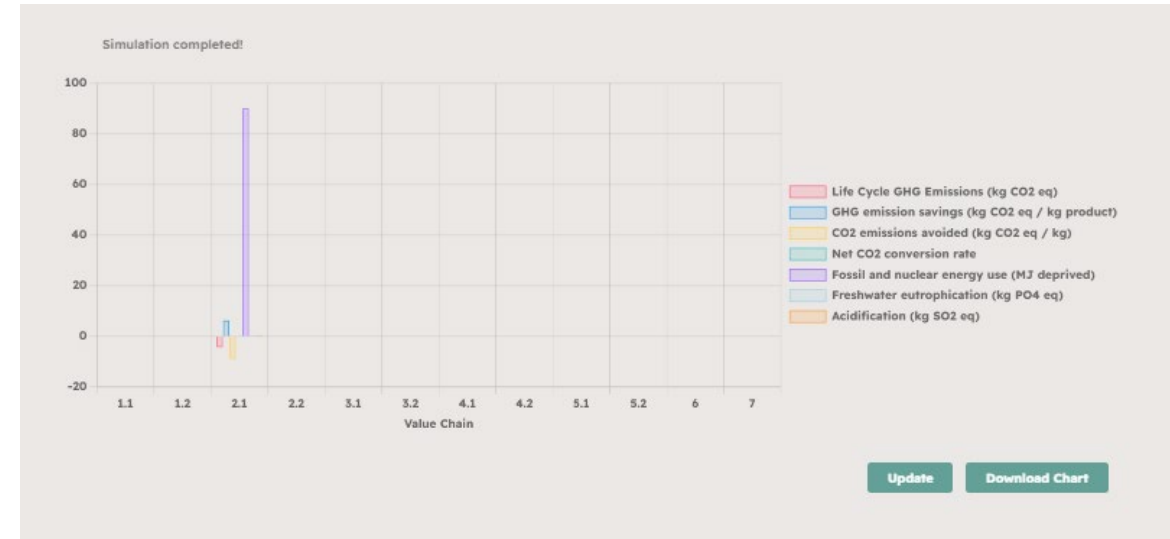
- Life Cycle GHG Emissions (CO₂)
- GHG Emissions Savings (CO₂)
- CO₂ Emissions Avoided (CO₂)
- Net CO₂ Conversion Rate
- Fossil & Nuclear Energy Use
- Acidification
- Freshwater Eutrophication

Dynamic Parameters

Enter your desired values for the dynamic parameters, then click 'Submit' to run a customized LCA simulation. Once the simulation is complete, click 'Update' to visualize the results on the graph.

Lignite Fraction:	Oil Fraction:	Biomass Fired Fraction:	Nuclear Fraction:
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0.22"/>
Natural Gas Fraction:	Hydropower Fraction:	Coal Fraction:	Photovoltaic Fraction:
<input type="text" value="0.19"/>	<input type="text" value="0.15"/>	<input type="text" value="0.15"/>	<input type="text" value="0.10"/>
Wind Fraction:	Transportation Distance:	<input type="button" value="Submit"/>	
<input type="text" value="0.19"/>	<input type="text" value="0"/> Km		

Simulation Results





Thank you

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