

Biomass Utilization Cluster

Collaborative Innovation for Low-Carbon Emitting Technologies

The objective

The objective of the Biomass Utilization cluster of the World Economic Forum's Collaborative Innovation for Low-Carbon Emitting Technologies (LCET) is to accelerate the transition to net-zero chemicals production by creating carbon sinks via biomass pathways through large-scale commercial lighthouse projects.

Background

The chemical industry has already continuously reduced CO₂ emissions associated from chemical production and many companies have set themselves ambitious goals to further reduce their environmental footprint. However, the optimization of current production processes has technical limitations. Therefore, industry needs to deploy new low-carbon emitting technologies that enable it to contribute to the climate goals

The chemical industry's GHG emissions come from two sources: energy-related emissions (85% of total emissions) and process-related emissions (15% of total emissions).¹

In 2019, the Governors Community for the Chemical and Advanced Materials Industry created the LCET initiative. The objective of the initiative is to accelerate the development and upscaling of low-carbon emitting technologies for chemical production and related value chains. The ambition of the initiative is to set the industry on a path to net-zero emissions by 2050.

Biomass Utilization is one of the five technology clusters identified as part of the initiative, along with Carbon Capture and Utilization, Electrification, Alternative Hydrogen Production and Waste Processing.

The opportunity

Using biomass as feedstock for chemical applications presents the advantage of eliminating fossil carbon emissions both in the production process and at end of life. It is a circular economy solution for converting waste and residues into valuable product.

Therefore, the use of alternative bio-based feedstocks will reduce the demand for fossil feedstock. The GHG

emissions reductions of bio-ethylene production are estimated at over 90%.² Coupled with CCU technologies biomass can create carbon sinks.

The potential of avoiding emissions using biomass is estimated at up to ~1.4 Gt (if 40% of demand in 2050 is met with bio-based plastic produced with carbon-free energy). Today, if only 10% of demand was met with bio-based feedstock, approximately 150 Mt of emissions could be avoided³, which represents 33 million cars off the road.

Biomass utilized must be produced sustainably in order to reach full CO₂ reduction potential.

State of the art and challenges

The European chemical industry already uses renewable feedstock, in total about 8 Mt, which represents 10% of the total carbon feedstock requirement of 79 million tons. Sustainable biomass, which is not competing with alternative uses, will play a larger role in the future.⁴

Technologies for biomass utilization in industrial processes are available at advanced technology readiness level; for instance, the biomass to ethanol process with the first commercial scale cellulosic ethanol plants being built.

Nevertheless, scaling up biomass utilization will require regulatory support to become commercially viable given the current price of oil and the need for regionally available biomass. The CO₂ abatement potential of biomass utilization is not yet fully understood. Therefore, life cycle analysis needs to be assessed together with the techno-economic potential.

Our approach

To develop new biomass-to-chemical processes and scale up existing efforts with a larger group of committed companies, members of the LCET Biomass Utilization cluster decided to focus on the development of two large-scale commercial lighthouse projects.

They identified two main work streams for their collaboration activities:

- Biomass to bio-ethylene to bio-ethylene oxide and polymers

¹ Clean Technology Scenario, The Future of Petrochemicals, IEA, 2018

² Production of Bio-ethylene, Technology Brief, IRENA, 2013

³ Industrial Transformation 2050, Material Economics, 2019

⁴ Low carbon energy and feedstock for the European chemical industry, DECHEMA, 2017

- Biomass to syngas to methanol

A **life cycle analysis** (LCA) and a **techno-economic analysis** (TEA) will be performed to provide more accurate estimations of potential CO₂ abatement of the two lighthouse projects, including an eventual carbon capture step in the LCA.

Outputs of the two analyses will be used to create the business case and define the technical, commercial and legal agreement details for the projects.

The cluster has decided to focus on residues from forestry, agriculture, food processing, bioprocessing and other non-food competing feedstock such as municipal solid waste.

Therefore, the following will remain out of scope: feedstocks such as food-crops or algae, products such as energy or biofuels, CO₂ as a feedstock.

Progress through 2019

After the initiative kick-off meeting (hosted by BASF) in July 2019, the technology cluster advanced the development of the work streams and convened in November (hosted by Clariant) for a workshop to define the scope of the work.

Preliminary roadmaps for potential collaborations including the scope, state-of-the art, challenges, opportunities, timeline and resources needed have been defined at the Second Technology Meeting on 5-6 December 2019 hosted by the World Economic Forum in Geneva.

Current activities and next steps

The cluster members have planned regular calls to further develop their roadmap. Additional studies, including the LCA and TEA analyses for the two lighthouse projects, will be performed.

To lead the effort towards large-scale commercial development of the two lighthouse projects, a consortium will be created to facilitate joint development agreement (R&D), stakeholder engagement, policy and financing innovation.

Calendar

2020-2021 key events:

- The Governors Community for the Chemical and Advanced Materials Industry convened at the World Economic Forum Annual Meeting 2020 in Davos-Klosters (19-24 January 2020)
- The Third Technology Meeting will take place in June 2020 (tbc)
- The Fourth Technology Meeting will take place in October 2020 (tbc)
- The Governors Community for the Chemical and Advanced Materials Industry will convene at the World Economic Forum Annual Meeting 2021 in Davos-Klosters (26-29 January 2021)

Participants

The LCET Biomass Utilization cluster is composed of chief technology officers and senior technology experts from partner organizations in the chemicals, materials and oil and gas sectors, experts in process technology and selected emerging technology leaders.

LCET Biomass Utilization cluster partner organizations

- BP Chemicals
- Clariant (lead)
- Covestro
- Johnson Matthey
- Mitsubishi Chemical Holdings Corporation
- Royal DSM (co-lead)
- SIBUR
- Solvay
- Versalis
- Wacker Chemie

How to engage?

Other companies from relevant industries are invited to join and engage with the core partners group. This includes, but is not limited to, sugar-makers, ethanol/ethylene producers, gasifiers, and food and consumer goods companies.

Other organizations such as governments, knowledge partners, industry associations, research institutes and universities are welcome to join the project activities and dialogues.

The LCET initiative is a part of the [Mission Possible Platform](#).

For more information on this initiative and to engage, please visit the [LCET initiative webpage](#) or contact:

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