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# Alternative carbon sources for chemical value chains

**Dr. Sean Simpson**

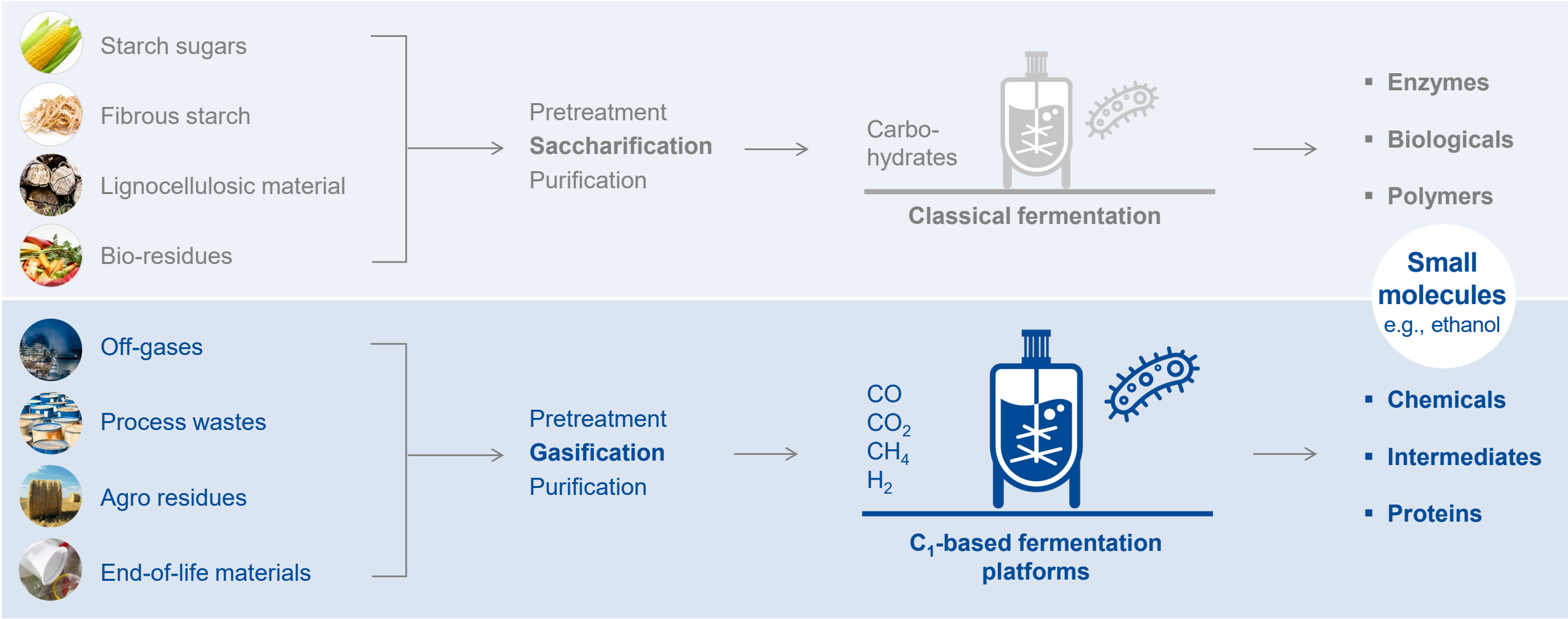
Chief Scientific Officer & Co-Founder, LanzaTech

**Prof. Michael Helmut Kopf**

Director Alternative Fermentation Platforms

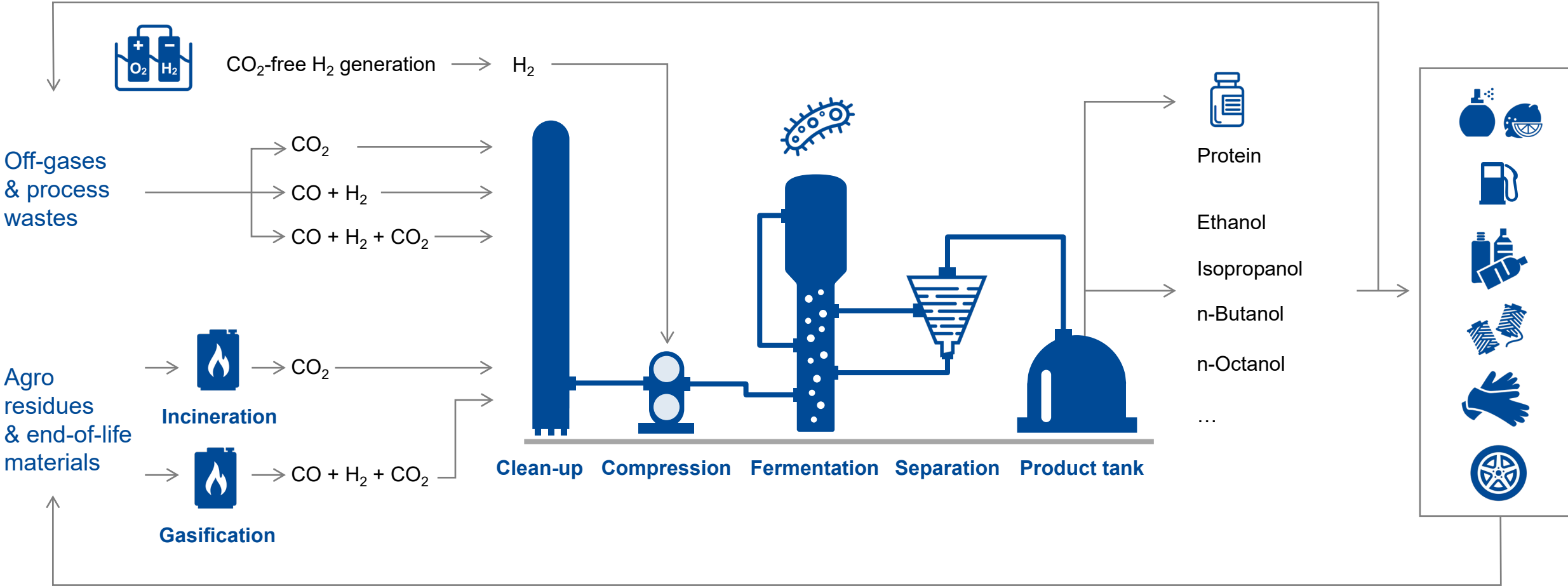
BASF Research Press Conference, November 17, 2022

# Classical and alternative fermentation platforms: Integrating alternative carbon sources into chemical value chains



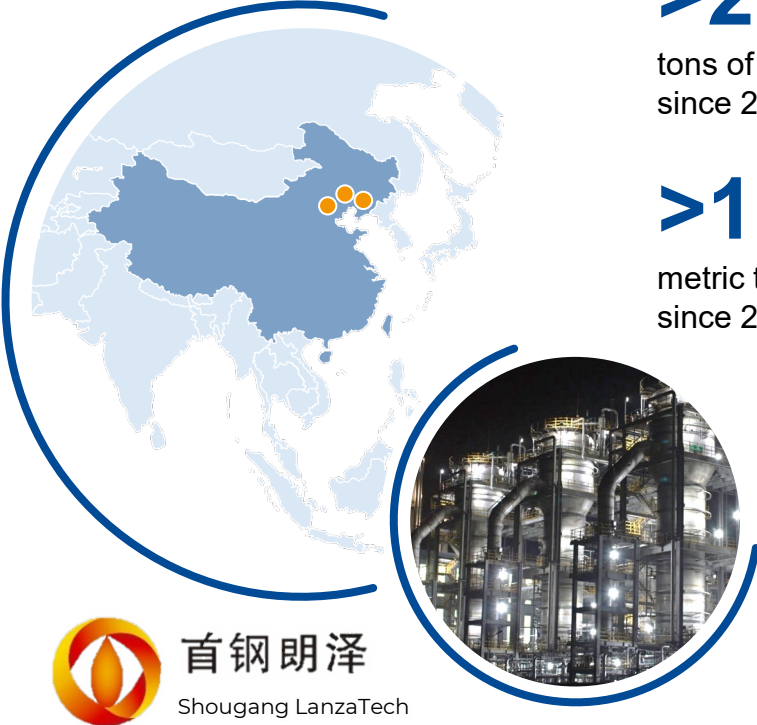


# Using nature's synthesis power: Programmable microbes as micro-catalysts



# LanzaTech's gas fermentation technology is a reality: Three commercial-scale plants in China and one in Belgium<sup>1</sup>

## China



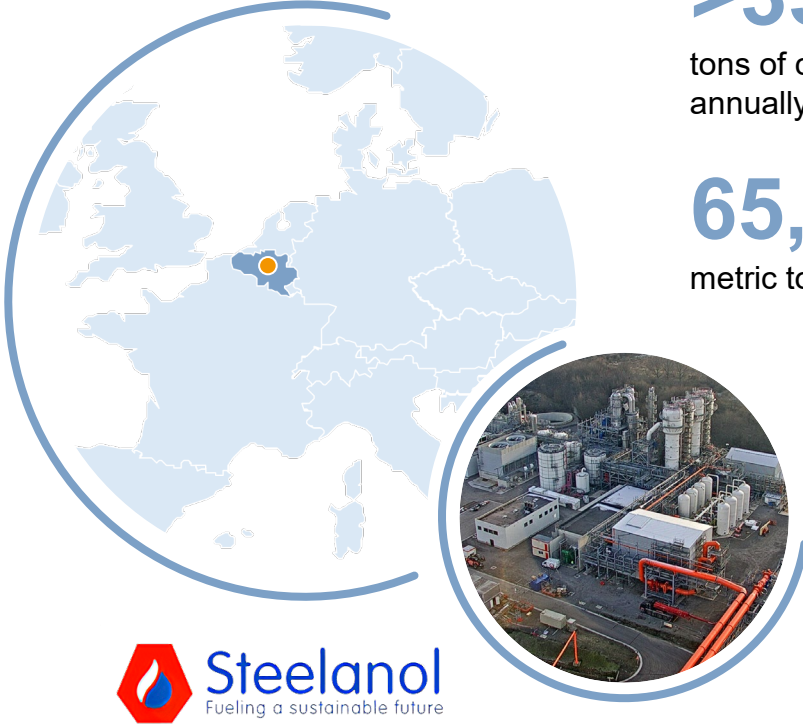
**>200,000**

tons of carbon dioxide avoided since 2018

**>150,000**

metric tons ethanol produced since 2018

## Belgium



**>350,000**

tons of carbon dioxide mitigated annually

**65,000**




metric tons ethanol per year



# Feedstock: Multiple gas feedstocks enable raw material availability in different regions and industrial sectors

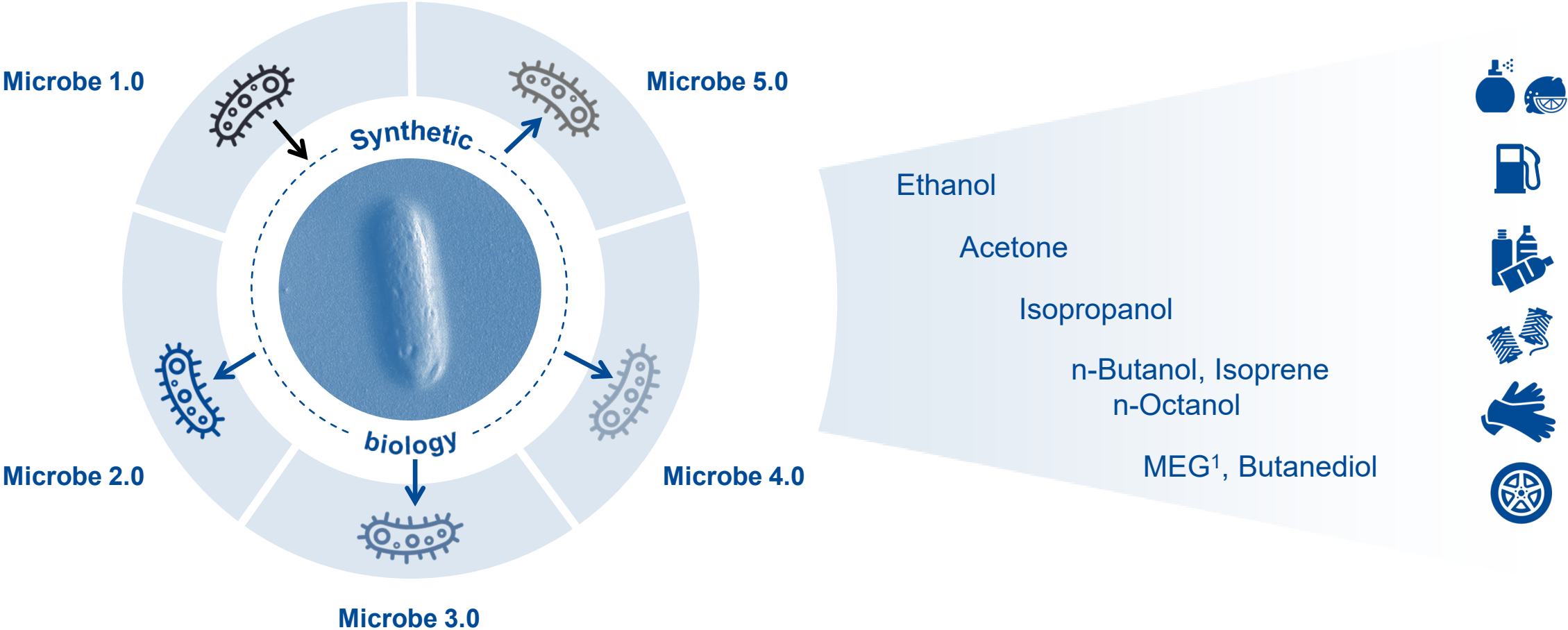
Potential  
Metric tons/year ethanol equivalents



-  Fossil raw materials
-  Mixed fossil & bio-based raw materials
-  Bio-based raw materials

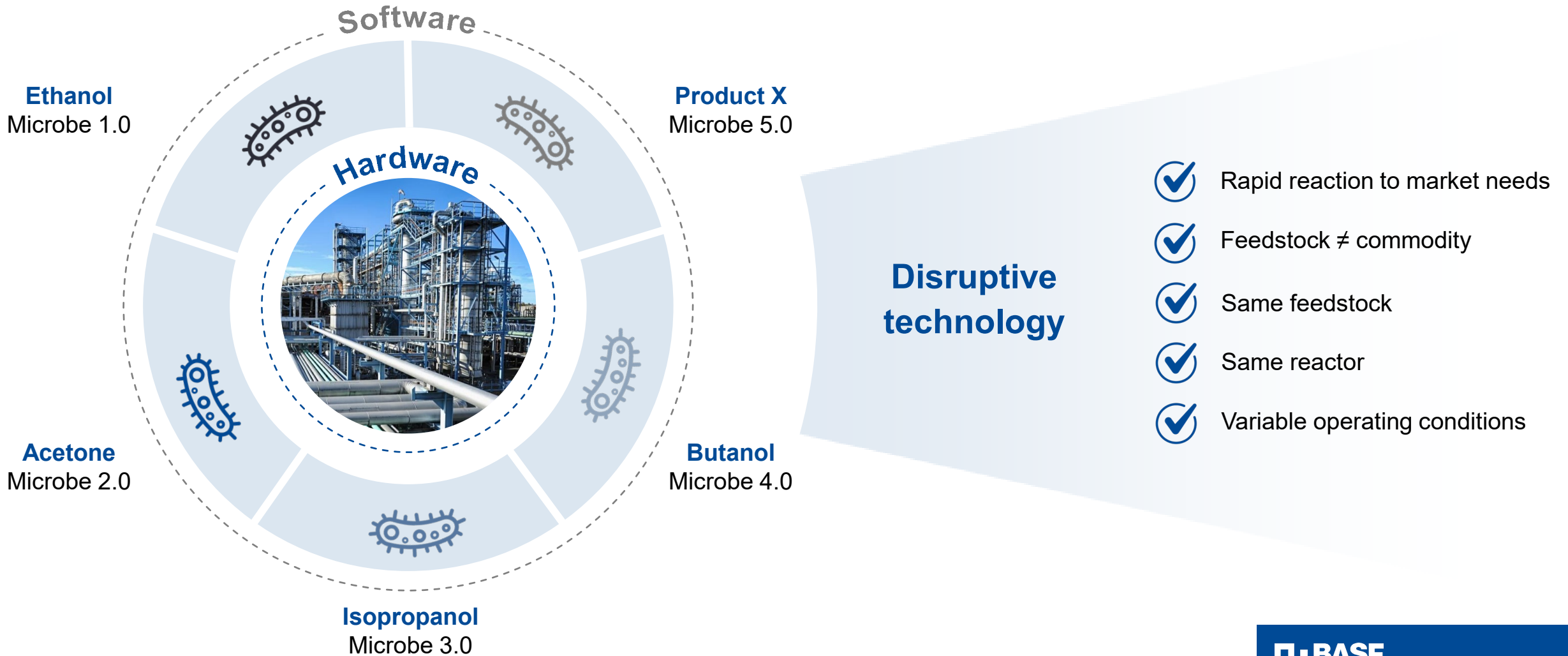


# Synthesis: Genetic engineering enables direct, fermentative synthesis of chemicals using gaseous carbon sources

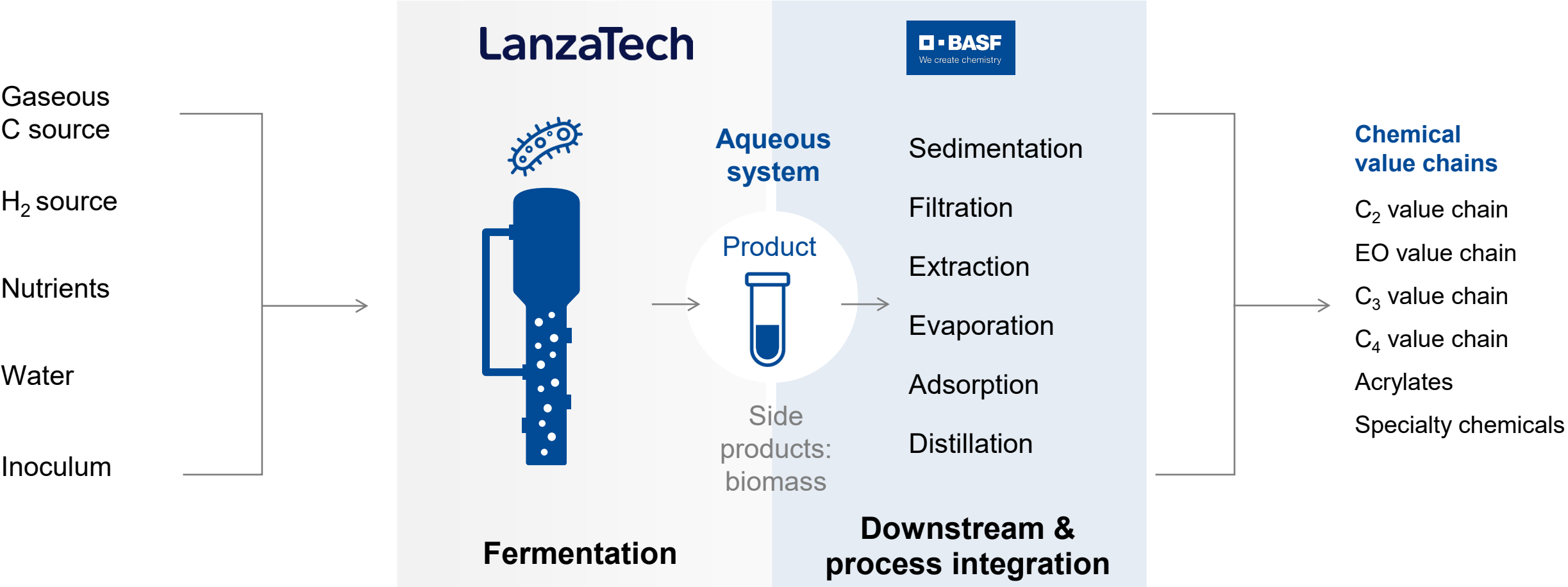


Engineered microorganisms enable the production of chemicals. The process locks CO<sub>2</sub> into the product and enables carbon-negative production.

# Apparatus concept and catalyst: A symbiosis like hardware and software enables disruption

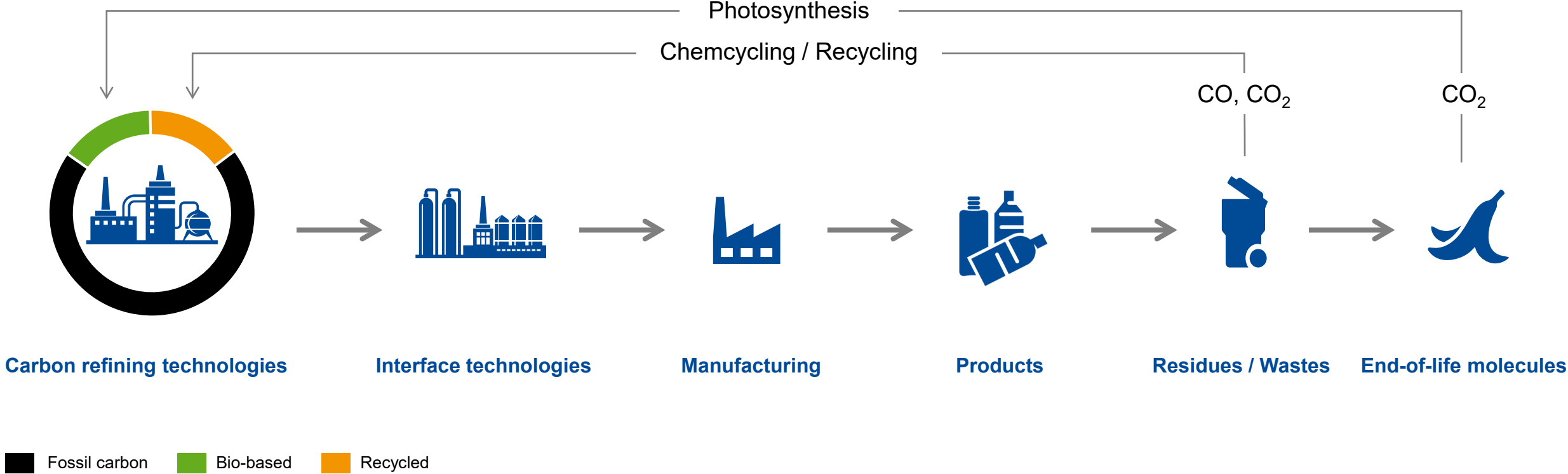


# Combining competences and capabilities leads to success!



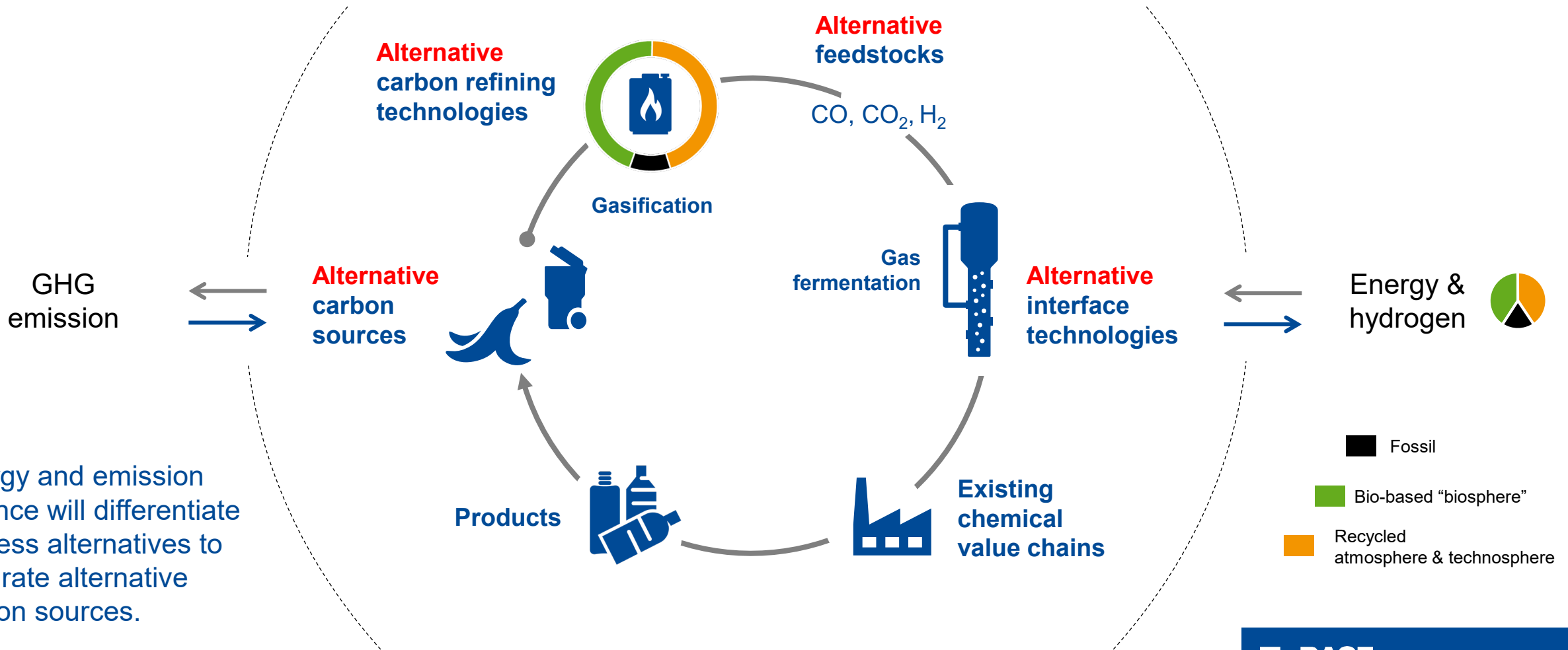


# To date, classical chemical value chains largely depend on fossil raw materials, thus constantly increasing aboveground carbon



BASF works on increasing the share of circular carbon within its value chains and products.

# Ambitious outlook: Gasification and gas fermentation as complementary elements to integrate circular carbon into chemistry



Energy and emission balance will differentiate process alternatives to integrate alternative carbon sources.

# LanzaTech's gas fermentation platform: A valid option to increase sustainability of BASF's value chains

**1** Producing ethanol from emissions is not a dream – it is reality.

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**2** Turning emissions and wastes into valuable chemical precursors significantly contributes to the carbon and hydrogen cycle.

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**3** BASF and LanzaTech are partners in developing sustainable processes to produce chemical precursors and intermediates.

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**4** LanzaTech's gas fermentation platform is versatile and an enabler for cross-industry cooperation.

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**5** Sourcing precursors made from emissions and wastes is a valid option for BASF to increase sustainability in its value chains.

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**6** Future regulatory framework must foster the use of wastes and gaseous emissions as sustainable carbon sources for the chemical industry.

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