

ECOOVALUE - Smart and dynamic bioproduction with integrated CO2 valorization

Publieke samenvatting / Public summary

Aanleiding

While electrification can lead to decarbonization of the energy sector and reduce greenhouse gas (GHG) emissions, the chemicals- and food industry will inevitably rely on carbon. Here efforts focus on replacing petrochemically derived carbon with biobased alternatives. Fermentation processes in which CO₂ or renewable carbon sources are converted to value-added products (e.g. fuels, chemicals, building materials and food ingredients) will become essential for the transition to a bioeconomy. Current biomanufacturing processes still have a substantial carbon footprint. Achieving net-zero GHG emissions by 2050 will require valorization of inherent CO₂-release from biomanufacturing processes and electrification of remaining unit operations, as well as the introduction of new bioprocesses at commercial scale. Already now, challenges with the electric grid capacity prevent the implementation of new initiatives. In order for more biobased production processes to become available on an industrial scale in the future, solutions need to be developed to minimize grid expansion requirements, and to maximize the use of renewable electricity and recycle carbon released during (bio)manufacturing.

Doelstelling

The primary goal of the ECOOVALUE concept is to make biomanufacturing processes more easily integrable into the existing electricity grid. Current fermentation processes will be (re)designed to no longer operate with pre-set or stationary conditions,

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Algemene informatie / General information

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Publicaties en materialen / Publications and attachments

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Voortgangsrappportage 1

Links

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but to allow dynamical operation to be able to respond to fluctuations in supply and demand of local renewable electricity sources. Periods of low costs for electricity can be leveraged so that these processes can operate more cost-effectively, while also providing a form of peak shaving to the grid by reducing demand during peak times. This is deemed essential for fast deployment of novel bioprocesses without further large extension of the electricity grid. There is a particular focus on energy-intensive electrochemical processes that convert CO₂ into value-added chemicals, for which the innovations aimed for in this initiative will be essential to become cost-effective on industrial scale. With this approach, ECOOVALUE presents innovations in manufacturing chains, as well as stimulates the use of CO₂ as substrate for value-added chemicals, and thereby elegantly addresses two innovation themes described in the MOOI-mission Industry.

Korte omschrijving

Analysis of the sensitivity of existing fermentation-based biomanufacturing processes for dynamic operation and (re)design of such processes to incorporate tuning to supply and demand fluctuations • Development of improved processes to recycle biogenic CO₂ streams by electrochemistry under dynamic operation • Development of processes for valorization of electrochemistry products (e.g. organic acids) using fermentation, enzymatic conversion or chemical synthesis • Design of algorithms to schedule optimal operation of processes • Techno-economic analysis based on renewable energy profiles • Upscaling of the most promising strategies to pilot scale (TRL6) at partner sites

Resultaat

To show wide feasibility of dynamic operation within the biomanufacturing industry the project will deliver • Proof of concept for dynamic operation in established fermentation processes to tune high energy demand during operation with availability of renewable energy and grid capacity • Demonstration of conversion of biogenic CO₂ to organic acids or intermediary products that are

either suitable as substrate for fermentation or for further chemical conversion • Protocols for maximal recycling of CO₂ released during biomanufacturing to minimize CO₂ emissions and enhance product yield • Integration of learnings into dynamic valorization of CO₂-derived intermediates in fermentation processes • Prediction tool for grid capacity/electricity price that allows for implementation of dynamic operation in (bio)manufacturing processes

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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