

JOINT PROJECT

Carbon2Chem[®]

KEEPING CARBON
IN THE LOOP



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Head of Carbon2Chem[®] sub-
project "System-Integration".*

L-0 | SYSTEM-INTEGRATION

NETWORK PLATFORM, OVERALL SYSTEM SIMULATION, LIFE CYCLE ANALYSIS

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Background

Within the Carbon2Chem[®] project, technologies are being developed to reduce CO₂ emissions at large industrial sites by using the emissions as a new source of raw materials for the chemical industry.

The focus lies on forming cross-industrial value creation chains and increasing energy efficiency by establishing cross-industrial networks.

This will be shown using the steel production site Duisburg/NRW as an example.

Aims

The aim of subproject L-0 is to integrate the technologies developed in parallel within subprojects L-I to L-VI into an overall system. Mathematical modeling and simulation as well as model-based optimization are important tools in this context.

Among other things, the scale-up of components and processes is realized; optimal operating points, control strategies and operation modes are determined; and – in particular – superordinate questions of system integration are answered during the development of the planned technical plant network.

Laboratory space will be made available for preliminary experimental investigations, which can be used jointly by all partners to test the technologies from all subprojects.



1 Carbon2Chem® laboratory, Oberhausen.

Tasks

Project duration 2020 to 2024

Within the Carbon2Chem® project, processes and logistics models are being developed that allow multi-criteria analyses for the economic and ecological optimization of operations. Furthermore, requirements for the operation of the cross-industrial network in the integration of renewable energies are investigated.

The schedules and operating modes determined in this process are examined and evaluated with the help of detailed process engineering models with regard to their transient behavior. The resulting specifications for the technological building blocks and components are discussed with the partners.

After evaluating the process engineering feasibility, the resulting input and output flows are examined in a sustainability assessment.

The conceptual design, construction and operation of this overall system simulation platform are one of the core tasks of Fraunhofer UMSICHT.

Milestones

Project duration 2016 to 2020

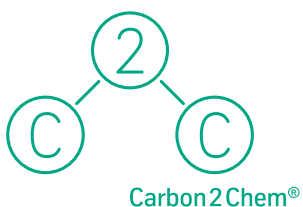
- Definition of standards and methods for simulation and Life Cycle Analysis (LCA) for the overall project
- Creation of a steel mill plant model
- Establishment of a library with state-of-the-art models (SAM) and detailed models for the chemical processes used in L-I to L-VI
- Creation of models for energy and electricity systems
- Preparation of an accompanying study, including an analysis of possible products and research on H₂ sources
- Development of a platform for a distributed simulation, which enables the partners to integrate their own models for invoices into the plant system via the network
- First economic and eco-assessment for methanol production
- Construction and commissioning of the shared Carbon2Chem® laboratory at the Oberhausen site
- Conducting of the first Carbon2Chem® conference

Project duration

The second Phase of the Carbon2Chem® project started on June 1, 2020. In the first phase from 2016 to 2020, the focus was on the elaboration of basic principles and feasibility studies as well as the evaluation and development of required technologies. Now, in the second phase, the scale-up towards pilot plant operation follows, in which the preferred plant concepts will be tested and verified with real gases. Subsequently, the implementation phase (2 years) is planned, in which the results will be transferred to industrial application.

Further project partners in L-0

- thyssenkrupp AG (coordination)
- Max Planck Institute for Chemical Energy Conversion (MPI CEC)
- Siemens AG
- Siemens Energy Global GmbH Co.KG



Further information

www.umsicht.fraunhofer.de/carbon-cycle

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