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## L-0 | System-Integration

**Network platform, dataspace, overall system simulation, life cycle assessment**

*Carbon2Chem®-laboratory, Oberhausen.*

### Background

Within the Carbon2Chem® joint project, technologies are being developed to reduce CO<sub>2</sub> emissions at large industrial sites by using gases with CO and CO<sub>2</sub> as a source of raw materials for the chemical industry.

The focus lies on forming cross-industrial value cycles and increasing energy efficiency by establishing cross-industrial networks for a climate-neutral production.

This will be shown using the steel production location Duisburg in North Rhine-Westphalia as an example.

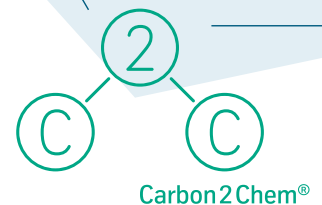
### Objective

Subproject L-0 aims to integrate the technologies developed in parallel within subprojects L-I to L-IV into an overall system. Mathematical modeling and simulation and model-supported optimization are important tools here. They make it possible, for instance, to scale-up components and processes, determine optimum operating points, control strategies, and identify modes of operating. The subproject also handles overarching research questions concerning system integration in the development of the planned technical plant network.

To conduct preliminary experimental investigations, laboratory space, which can be used jointly by all of the partners to test the technologies from all subprojects, will be made available in the project.

**“**Utilization concepts for process-related carbon dioxide are an important element in the path towards climate-neutral production.”

Dr.-Ing. Thorsten Wack  
Head of the Carbon2Chem®-subproject “System-Integration”



## Tasks

As part of the Carbon2Chem® project, process-logistical models will be developed that enable multi-criteria analyses in order to optimize operations economically and ecologically. Requirements for the operation of the cross-industrial network when integrating renewable energies will also be investigated.

The schedules and modes of operation determined in this way are investigated and assessed with the help of detailed process engineering models with regard to their transient behavior. The requirements that arise from this for the technological elements and components are discussed with the partners in the individual subprojects.

Following the evaluation of process-related feasibility, the resulting input and output flows are investigated and evaluated in a sustainability assessment (life cycle assessment).

The design, setup and operation of the overall system simulation platform inclusive dataspace are one of the core tasks of Fraunhofer UMSICHT.

## Milestones

- Definition of standards and methods for simulation and life-cycle assessment (LCA) for the over-all project
- Creation of mathematical models of the “steel mill” as well as alternative CO<sub>2</sub> sources
- Establishment of a library with state-of-the-art models and detailed models for the chemical processes used in the sub-projects L-I to L-V
- Creation of models for the energy systems
- Preparation of technology fact sheets, including an analysis of possible products and research into H<sub>2</sub> sources
- Conceptual design, set-up and operation 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
- Provision of a dataspace for data integration and analysis
- Preparation of economic and eco-assessment for methanol production
- Construction and commissioning of the shared Carbon2Chem® laboratory at the Oberhausen site
- Conducting of the Carbon2Chem® conferences

## Project duration

The green light for the second phase of the Carbon2Chem® joint project was given on June 1, 2020. The focus in the first phase from 2016 to 2020 lay on developing basic principles and conducting feasibility studies as well as evaluating and developing the necessary technologies. This is now followed in the second phase by the scale-up towards pilot plant station operation, in which the preferred plant concepts should be tested and verified with real gases. The implementation phase (2 years) is then planned, in which the results are brought into industrial application.

## Further informationen

### Other 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

### Projekt website

[www.umsicht.fraunhofer.de/carbon-cycle](http://www.umsicht.fraunhofer.de/carbon-cycle)

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