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L-I | CO_2 Sources and Infrastructure

Sources and development over time, transformation path, process concepts, demonstrator

Carbon2Chem® laboratory, Oberhausen.

Background

Within the Carbon2Chem® joint project, technologies are being developed to reduce CO_2 emissions at large industrial sites by using gases with CO and CO_2 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-I aims to identify further CO_2 sources outside of the steel industry and create a CO/CO_2 matrix, which, alongside the composition and size of the sources, also takes into account the respective locations and their foreseeable development over time. The use of alternative energy sources or new process routes also brings with it changes to the CO_2 flow and content in the process gases and in the waste gas. The production of lime is taken into account as well as thermal waste treatment. Questions about the infrastructure concern CO_2 as well as the availability and provision of hydrogen produced using greenhouse gas-neutral methods. Corresponding transformation paths should be highlighted and evaluated, supplemented by process concepts and demonstrators.

> "Carbon dioxide and hydrogen will be two key components that need to be transported, stored and processed safely and in a legally compliant manner."
>
> Prof. Dr.-Ing. Ulrich Seifert
> Head of the Carbon2Chem®-subproject "CO_2 Sources and Infrastructure"

Carbon2Chem®

Tasks

The systematic recording and description of current CO and CO_2 sources in industrial processes outside of steel production form the starting point for determining current and future expected process gas flows containing CO/CO_2 as feedstock for the production of chemicals.

The examples of lime production and waste incineration should be used to ascertain information about the temporal and geographical availability of these gases as well as other gas components and prepare and present this information with regard to future development. The expected influence of technical and regulatory framework conditions should be highlighted as part of this. Based on this, the specific hydrogen requirement and the necessary infrastructure are to be determined and evaluated based on location.

The process concepts to be formulated, specifically for modular/decentral plants, are provided to the "Simulation" and "Sustainability assessment" communities as input.

Milestones

- Static CO/CO_2 matrix with main and secondary components
- Carbon matrix of main users
- Change of the carbon matrix over time based on new technologies, legal amendments and changes in requirements
- $C/CO/CO_2$ matrix with the main and secondary components incl. expected changes over time by 2050
- Implications of location-specific characteristics on approval procedures
- Concept to derive possible transformation paths
- Description of possible transformation paths
- Evaluation of exemplary process and operational concepts
- Concepts to transfer existing solutions to container systems
- Analysis of the gas network and electricity grid with regard to the necessary infrastructure

Project duration

The green light for the Carbon2Chem® project was given on March 15, 2016. In the second project phase (start: June 1, 2020, duration: 4 years), the focus lies on demonstrating the robustness of the previously developed concepts to purify steel mill gases, to synthesize various chemicals and, in particular, for system integration. An industrial implementation and basic engineering/PDP of the system networks should be technically feasible with the completion of the second phase.

Further information

Other Project partners in L-I

- thyssenkrupp AG (coordination)
- Lhoist Rheinkalk Germany
- Remondis (associated partner)
- thyssen Vermögensverwaltung
- Gemeinschaftsmüllverbrennungsanlage Oberhausen (associated partner)

Project website

www.umsicht.fraunhofer.de/carbon-cycle

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