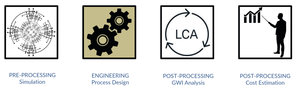
Carbon2Chem®

Process Design Community Technical Implementation

The Carbon2Chem® Communities



Carbon2Chem® Process Design Community represented by
thyssenkrupp Industrial Solutions, Friedrich-Uhde-Str. 15, 44141 Dortmund, Germany, Dr. Matthias Krüger, matthias.krueger@thyssenkrupp.com
Fraunhofer UMSICHT, Osterfelder Strasse 3, 46047 Oberhausen, Germany, Dr. Sebastian Stießel, sebastian.stiessel@umsicht.fraunhofer.de

Process design is the technical and mechanical engineering of a process plant based on simulation data and pre-defined boundary conditions. The results include, inter alia, operating points for pumps and compressors, vessel dimensions, estimated material weights and even whole equipment specifications. These can be used in the subsequent detail engineering process as well as form the basis for economic and ecological analyses and concept comparisons.

CONVENTIONAL PROCESS DESIGN WITHIN THE ENGINEERING OF A CHEMICAL PLANT

Flowsheeting (conventional): Block Flow, Process Flow as well as Piping & Instrumentation Diagrams show the interconnection between components and units of one distinct process concept on different levels of detail. Feedstock type, process design and product are typically fixed. According to the flow diagrams, mass flow, composition, pressure and temperature are assigned to each material flows based on the simulation results and documented in the heat & material balance.

PROCESS DESIGN UNDER CARBON2CHEM®-SPECIFIC BOUNDARY CONDITIONS

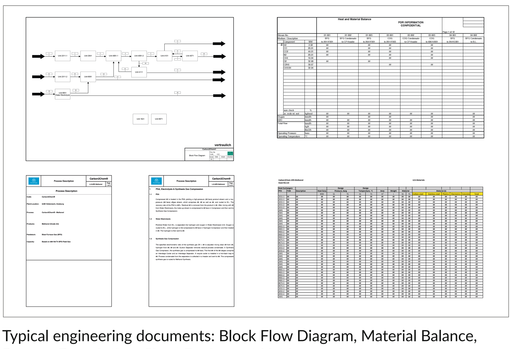
Flowsheeting (Carbon2Chem®): There is a large number of carbon and hydrogen sources, gas treatment options and products that can be combined in the Carbon2Chem® processes (cf. Table 1). Therefore, each unit is regarded as an interchangeable building block, and results can be transferred from one concept to the other. Results from composite and detail simulations from the simulation community are employed to yield energy and material balances of different complexity for each process concept.

Carbon Sources	Blast Furnace Gas, Coke-Oven Gas, Basic Oxygen Furnace Gas Flue Gases from Waste Incineration Plants, Lime and Cement Production
Hydrogen Sources	Water Electrolysis, Pipeline/Carrier, Methane Pyrolysis, Internal Sources
Gas Treatment Options	Fine Cleaning, Water Gas Shift, CO_2 Removal, Methanation, Pressure Swing Adsorption
Products	Ammonia/Urea, Methanol, Higher Alcohols, Polymers

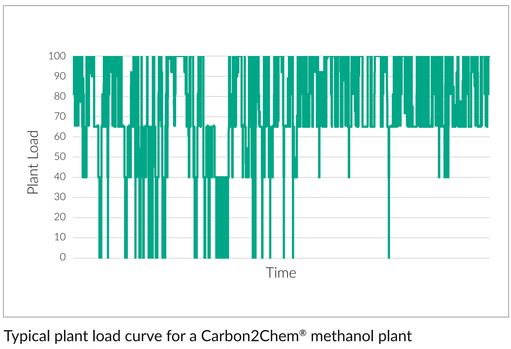
Table 1: Overview of available building blocks for the Carbon2Chem® process concepts

Equipment Design (conventional): All equipment is designed such that it serves a specific set of a few operating cases, e.g. different plant loads or end of run/start of run conditions. Resulting process data is documented in equipment specifications and typically used in detail engineering and cost estimation.

Equipment Design (Carbon2Chem®): Instead of distinct individual operating cases, boundary conditions such as plant load curves or gas or renewable energies volatility generate a distribution of operating cases, which are taken into consideration in equipment design. Process data is further processed in the communities for cost estimation and LCA.



Typical engineering documents: Block Flow Diagram, Material Balance, Process Description, Sized Equipment List incl. weights



Typical plant load curve for a Carbon2Chem® methanol plant
From: PLM simulation model by Fraunhofer UMSICHT

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A KEY BUILDING BLOCK FOR THE CLIMATE PROTECTION

CO_2 reduction by cooperation of process industrial sectors