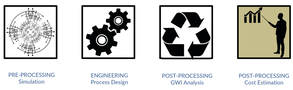
Carbon2Chem®

Cost Engineering Community

The Carbon2Chem® Communities



Carbon2Chem® Cost Engineering Community represented by
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As part of the overarching work package "System Evaluation", the "Cost Engineering" community bundles the activities for techno-economic evaluation of the process concepts developed in the "Process Design" and "Simulation" communities and compares them with various scenarios taking into account external boundary conditions like different H_2- or CO_2-prices.

CHALLENGES AND OBJECTIVE

The main challenges in determining investment and operating costs for the Carbon2Chem® process concepts are, on the one hand, the low availability of economic process data due to new plant components and, on the other hand, the changing plant configurations in the course of the project due to new findings from the other subprojects and communities. In addition, there is currently a high degree of uncertainty in the design of the legal framework conditions, which makes it difficult to calculate payback ratios for assessing the economic benefits of coupled production in the steel and chemical industries and requires the consideration of different scenarios. Key issues to be considered in the scenario-based techno-economic evaluation and optimization of the overall system are, for example, the provision of low-CO_2 hydrogen, consideration of emissions trading, and compensation for the additional costs of CCU/PtX products.

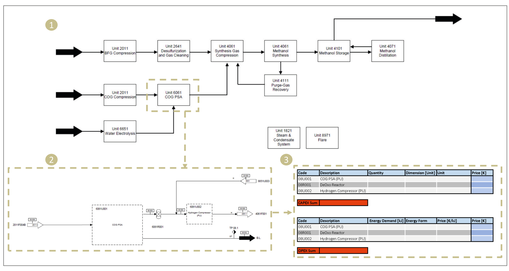
The aim of the work within the community is to determine investment and operating costs as well as payback ratios and to investigate sensitivities for the new overall system.

METHODOLOGY AND TRANSFERABILITY

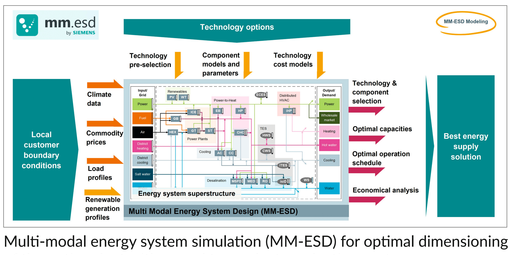
Against this background, different approaches and methods were combined within the scope of the work. A modular cost approach was chosen to determine the investment and operating costs. This makes it possible to estimate the costs of individual components of the process concepts on the basis of technical data (material, flow rate, pressure or temperature) and established estimation methods. In addition, the modular approach allows continuous changes on the part of the plant configuration to be taken into account in the cost estimation.

The use of renewable energy sources with their volatile character leads to fluctuating supply of the overall system on a short (minutes) to seasonal basis, whereby a constant utilization of such plants as usual can no longer be maintained or only very uneconomically. Operation now requires load-flexible plant control and the use of optimally dimensioned intermediate storage.

Multi-modal energy system simulation (MM-ESD) enables the optimal dimensioning of the entire plant with respect to the product generation costs (TOTEX), optionally including further optimization parameters and sensitivity to changing framework conditions. The chosen approach thus enables techno-economic estimates for comparable cross-industrial networks, for example based on the use of process gases from the cement industry or waste incineration plants.



3-step approach to cost estimation: 1. development of BFDs for overall concept, 2. transfer to PFDs for unit definition, 3. cost estimation of individual units & apparatuses.



Multi-modal energy system simulation (MM-ESD) for optimal dimensioning of the entire plant with regard to product production costs.

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A KEY BUILDING BLOCK FOR THE CLIMATE PROTECTION

CO_2 reduction by cooperation of process industrial sectors