C2C Carbon2Chem®

The Carbon2Chem® Communities

PRE-PROCESSING Simulation | ENGINEERING Process Design | POST-PROCESSING GWI Analysis | POST-PROCESSING Cost Estimation | Regulatory Framework
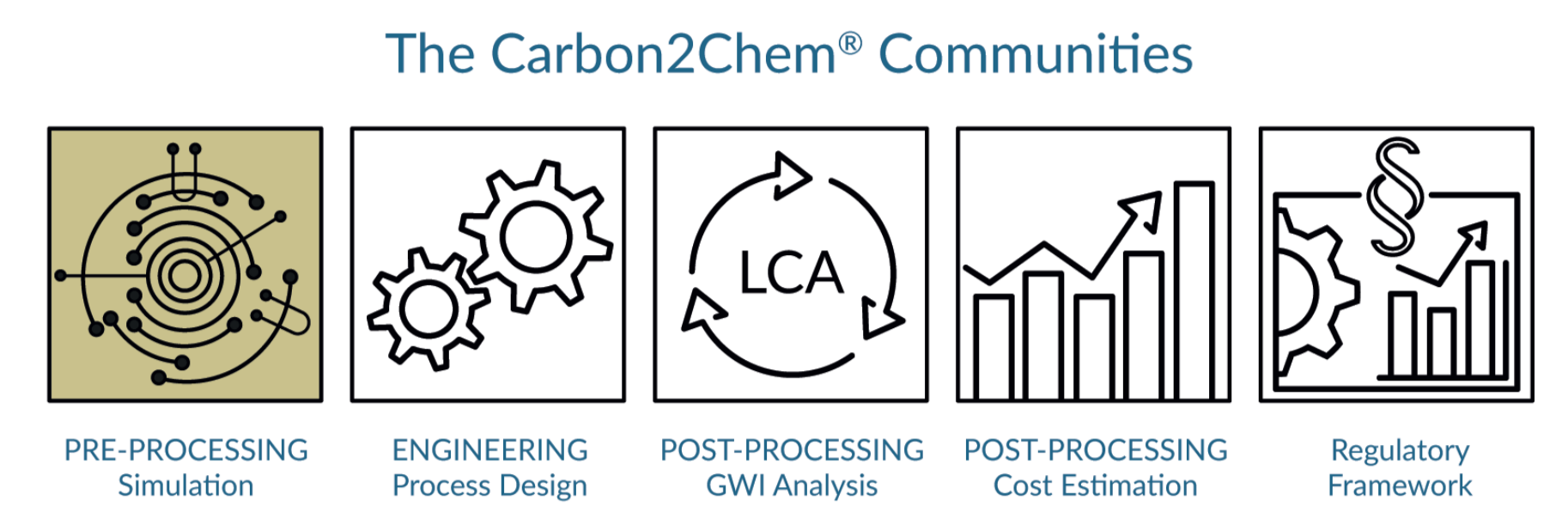
Simulation Community
Recognizing Connections and Opportunities

thyssenkrupp AG | Fraunhofer-Gesellschaft | Ruhr University Bochum | RWTH Aachen University | Siemens AG | Siemens Energy Global | Linde GmbH

thyssenkrupp | Fraunhofer | RUHR UNIVERSITÄT BOCHUM RUB | AVT RWTH AACHEN UNIVERSITY | SIEMENS | SIEMENS energy | Linde Making our world more productive

Challenge

Within the scope of Carbon2Chem® a multitude of cross-industrial plant network concepts shall be analyzed, evaluated for their CCU potential and prepared for engineering. Because no comparable network exists to this day, a detailed theoretical basis is necessary for this analysis. The Simulation Community brings together the specialist knowledge of 28 experts from various industrial sectors and scientific fields.

Objective
Finding the optimal CCU plant network

Time dependent raw gas supply, compression and purification, green H_2 demand and availability, chemical process and reduced power plant operation are investigated in a cross-industrial network simulation. The results give an inside view and lead to optimized design and economical and ecological evaluations. The goal is to find the best CCU concept and operation mode concerning energy and gas usage, CO_2 reduction and economical data, considering technical boundaries and limitations.

Methodology
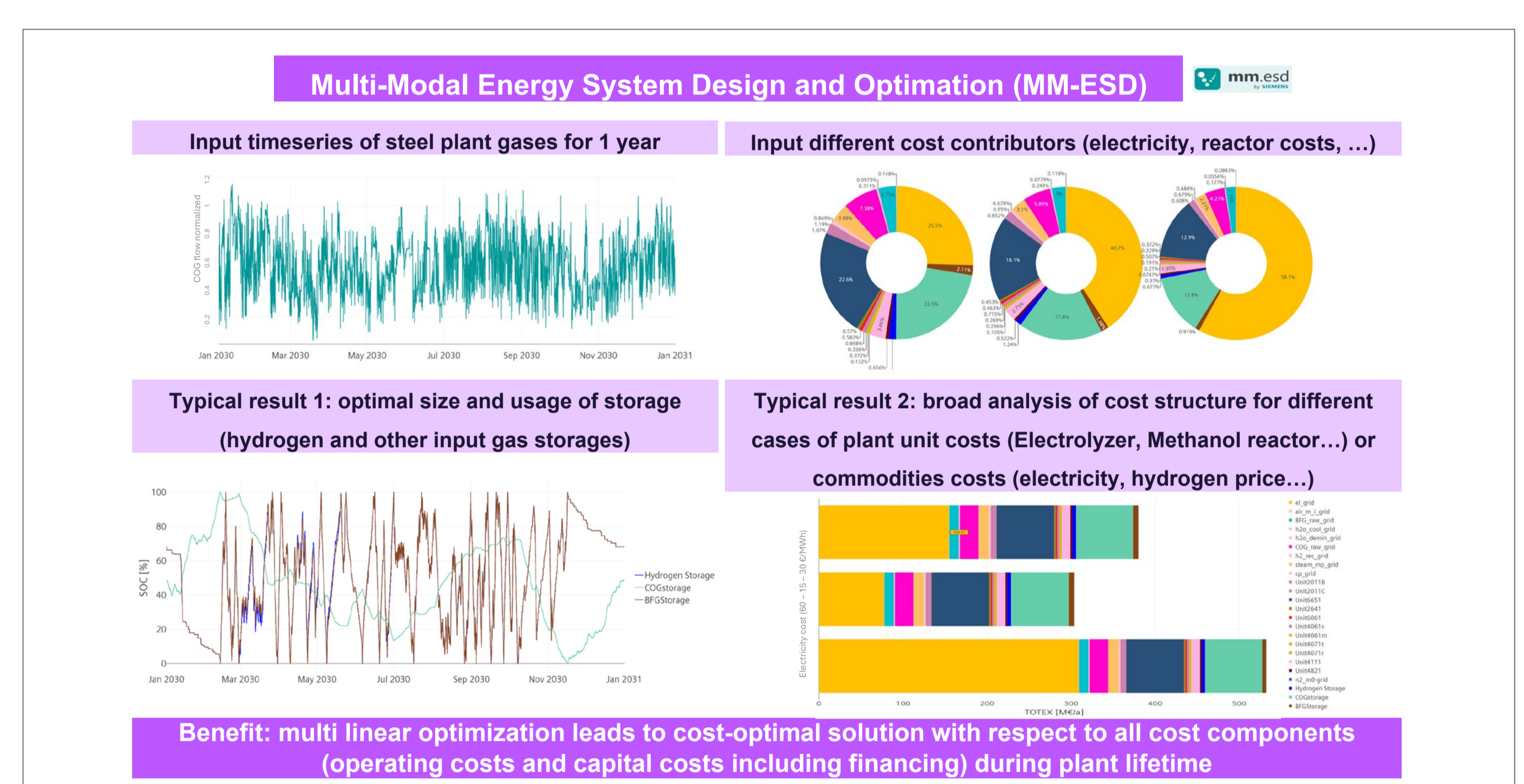## Cross-industrial network simulation and validation

Cross-industrial network simulation models and tools have been developed by independent teams working in cooperation within the community. Higher precision simulations were combined in hierarchical structure with less detailed models to form an overall network simulation. Results were validated against Carbon2Chem® technical center experiments. The predicted consumption or production of gases, hydrogen, products, process water, steam and energy is listed systematically for further processing as well as ecological and economic evaluations.

Transferability

Conclusions were delivered to process designers, potential investors and political decision-makers giving a concise overview of cross-industrial CCU concepts producing methanol or ammonia/urea from CO_2. These form the basis for CCU in the steel, cement and lime industry and for waste incineration. In project phase 3, an augmentation of the simulation tools shall reveal efficient, national economic cycles for energy storage and usage and circular CO_2-usage.
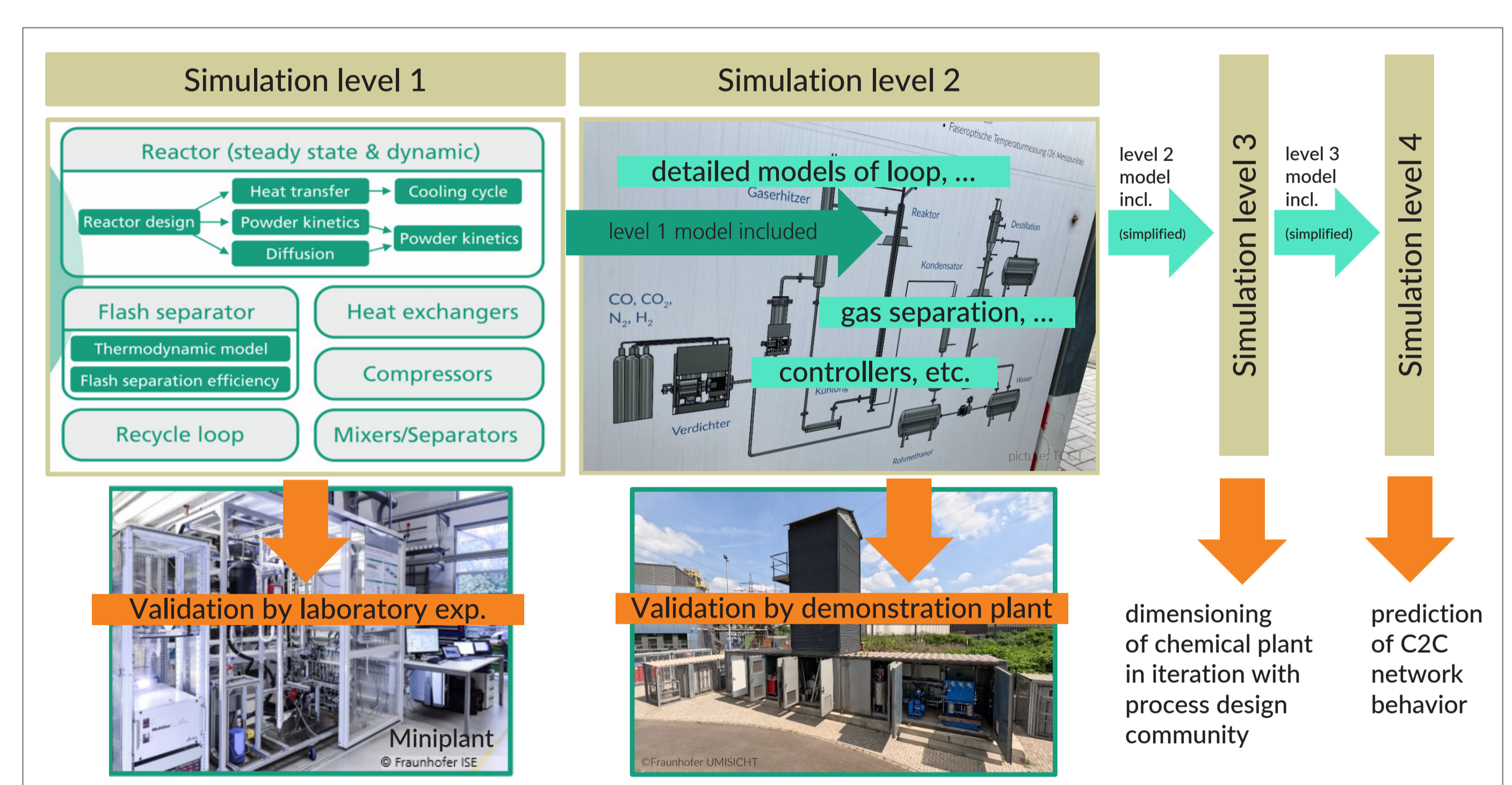
Hierarchical method of validation and application of the various models. Most detailed models (left) → largest scope of models (right).

Application: Prediction of Carbon2Chem® industrial network behavior and economics.
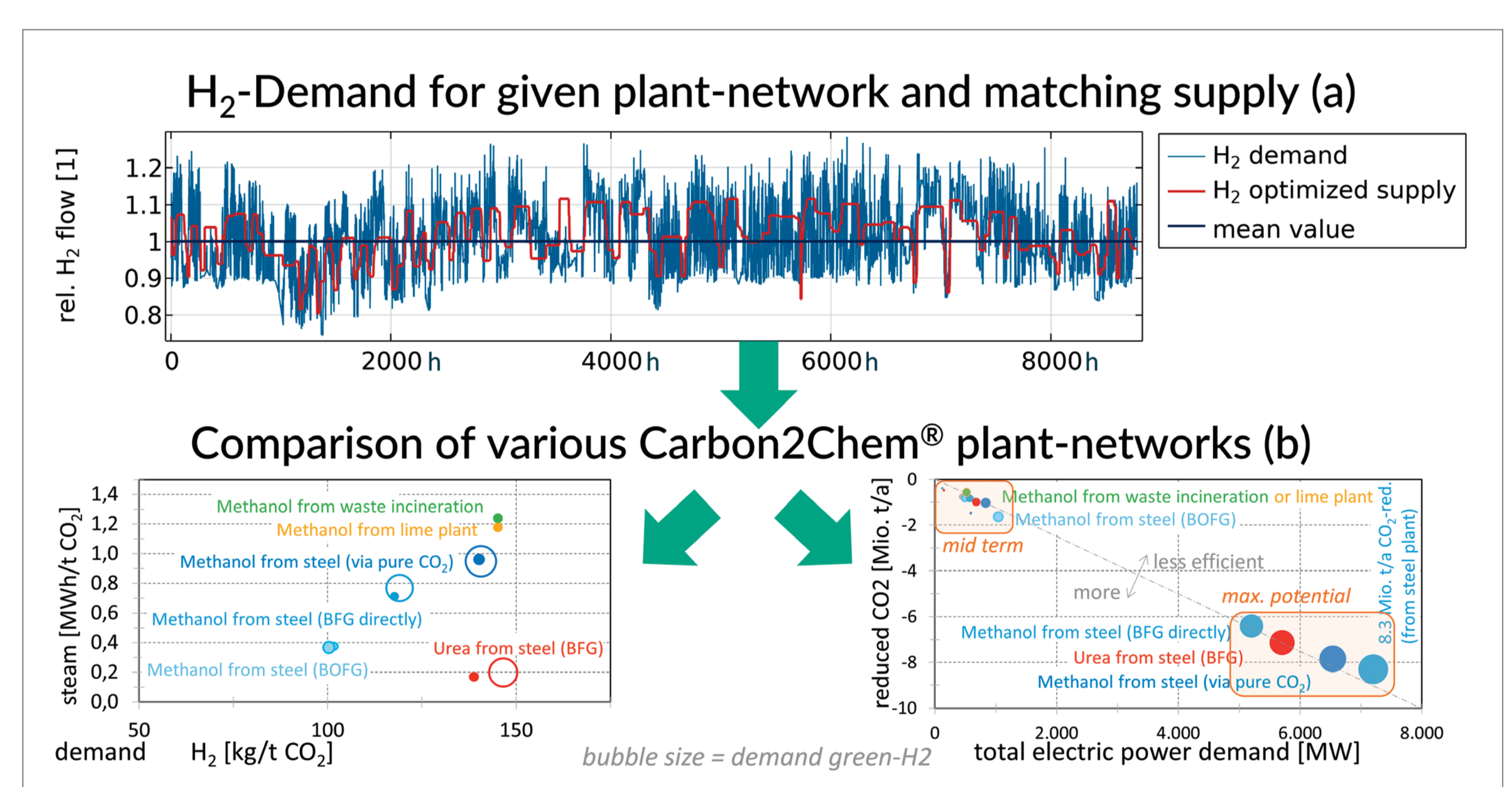
Applications: Prediction of H_2-demand/supply (a) and comparison of different CCU plant networks in Simulation Community (b).

A KEY BUILDING BLOCK
FOR THE CLIMATE PROTECTION

CO_2 reduction by cooperation of process industrial sectors