CDS
RESEARCH CENTER DYNAMIC SYSTEMS
SYSTEMS ENGINEERING

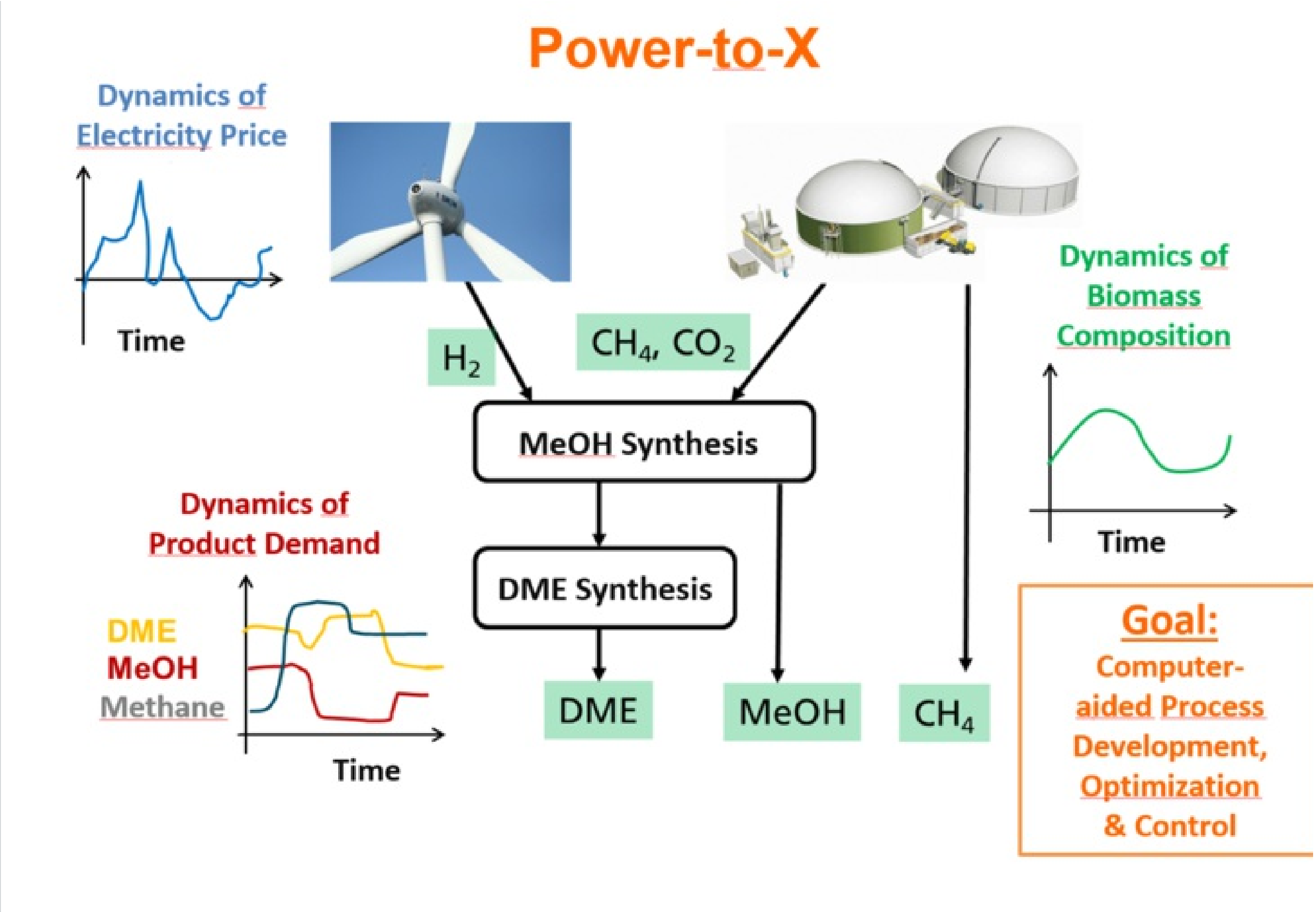
Energy Conversion

The area of Energy Conversion is concerned with ensuring a secure supply of electricity and heat from renewal energies. For this purpose, the electricity generated from renewable energies must be stored chemically, e.g. in the fo of hydrogen, over a longer period of time. Within the CDS, the development of computer-aided system designs and t optimisation of energy storage is pursued.

The implementation of the energy revolution in Germany requires the **efficient storage of energy** - in particular by converti electrical energy into hydrogen by means of electrochemical water splitting. Hydrogen can be converted into synthetic ener carriers ("eFuels"), e.g. methane and methanol, by hydrogenating CO2. These substances are not only the key to the effici storage of renewable energies, but also represent central nodes in the value-added creation chains of the chemical industry. T aim of the CDS's research work is to design, simulate and optimise novel "Power-to-x" processes taking into account dynamically varying supply of electricity.

Furthermore, **energy sources from biological production** ("biofuels"), in particular biomethane, are becoming increasin important. Its production requires efficient biogas plants for the anaerobic fermentation of energy crops as well as residual a waste materials from agriculture. In these plants, microbial communities transform the raw materials into methane and CO2. major goal of the research work is to gain a basic understanding of the complex degradation mechanisms in order to optimize t operation of biogas plants and to make the co-product CO2 usable for "Power-to-X" processes. The CDS is developing innovat adsorption and absorption processes for the efficient separation of methane and CO2. The feeding of e-methane and biometha into existing gas distribution networks causes dynamic variable flow and pressure distributions, which are simulated and optimiz with advanced mathematical methods.

In view of a fluctuating hydrogen supply, it is desirable to perform CO2 hydrogenation in catalytic reactors which can be operat with dynamically variable feed streams. However, so far there are hardly any reliable design methods for dynamically operat reactors and there are no tailor-made catalytic material systems which can withstand temporal fluctuations of gas composition a temperature. A consistent multi-scale analysis of the system dynamics covering the reaction and transport processes on t relevant time and length scales is mostly not available. This is another important topic area which the CDS is working on in clo cooperation with regional, national and international partners from science and industry.



Research

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