Flexible Power – To – X networks operation by a digital twin based energy management system

Dr. Moritz Wendt, Ramona Götz, Dr. Thomas Harlacher; Gordana Hofmann-Jovic, Michael Strack
Yncoris GmbH & Co. KG
E-mail: moritz.wendt@yncoris.com; ramona.goetz@yncoris.com; thomas.harlacher@yncoris.com, gordana.hofmann-jovic@yncoris.conm; michael.strack@yncoris.com

For efficient utilization of renewable energy sources intermittances and strong fluctuations of the availability of renewable energy and consumer demand need to be considered. Hence high storage capacities and flexible energy distribution is required. For this purpose, the conversion of electricity to hydrogen via electrolysis offers several options for direct use, storage, and distribution of renewable energy. Furthermore, hydrogen can react with CO_2 to produce hydrocarbons as energy carriers in gaseous or liquid forms such as methane, methanol or kerosine. This Power-to-X network can prevent CO_2 emissions since a closed loop of circulating carbon is realized.
For simultaneous operation of all process units a superordinate digitalized energy management system allows the determination of optimal operation strategies by model-based dynamic optimization and simulation approaches. In this presentation the conception and implementation of such an energy management system for the entire Power-to-X network including an electrolysis, direct air capture for CO_2 separation and a synthetic methane production is shown. This energy management system mainly coordinates the tasks for data transfer and the activation of those calculation tools for updating proposed operation strategies. The benefits of merging the process control system and the digital twin handling forecast data and process data by robust real time calculations are illustrated.