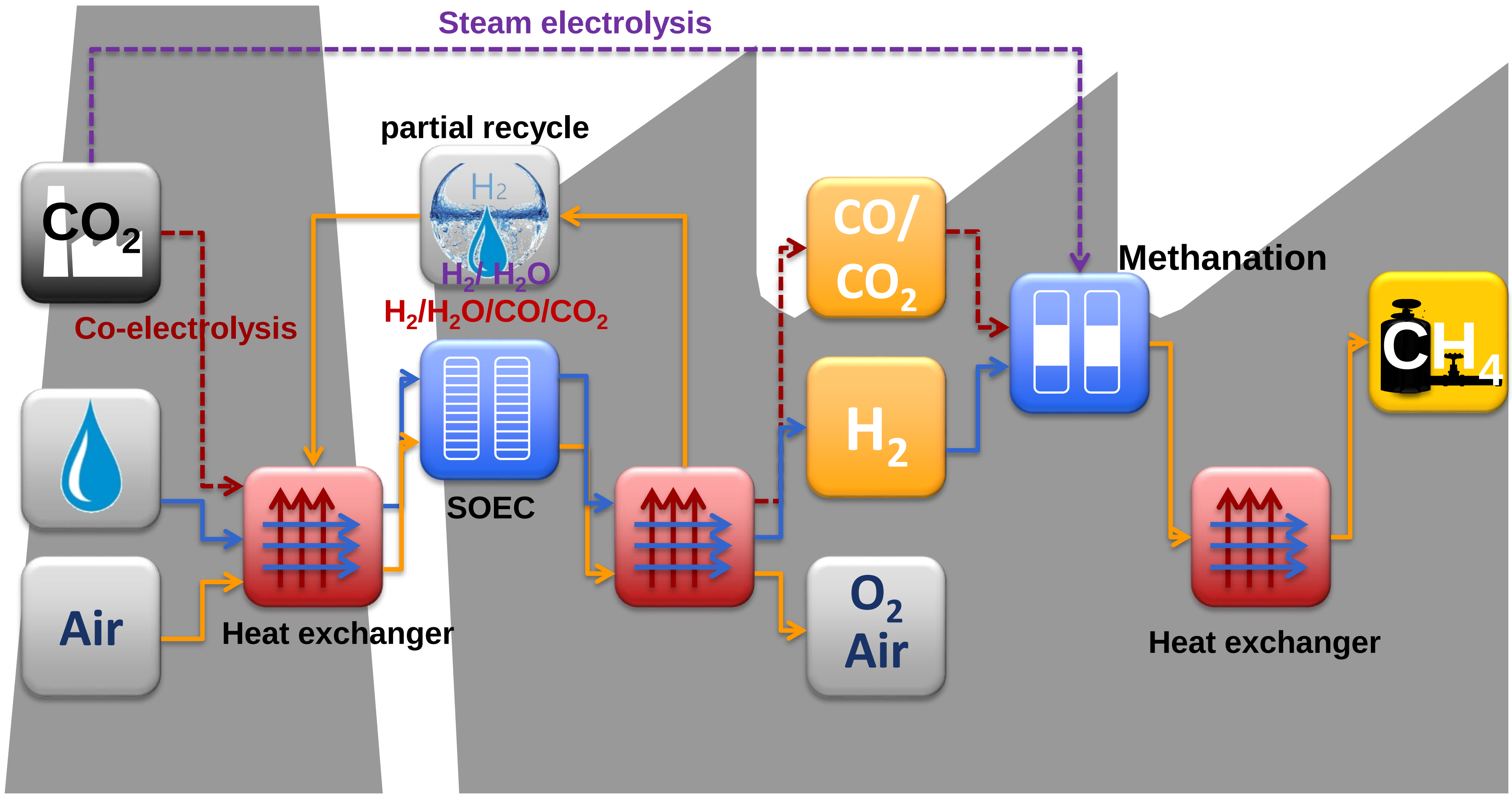
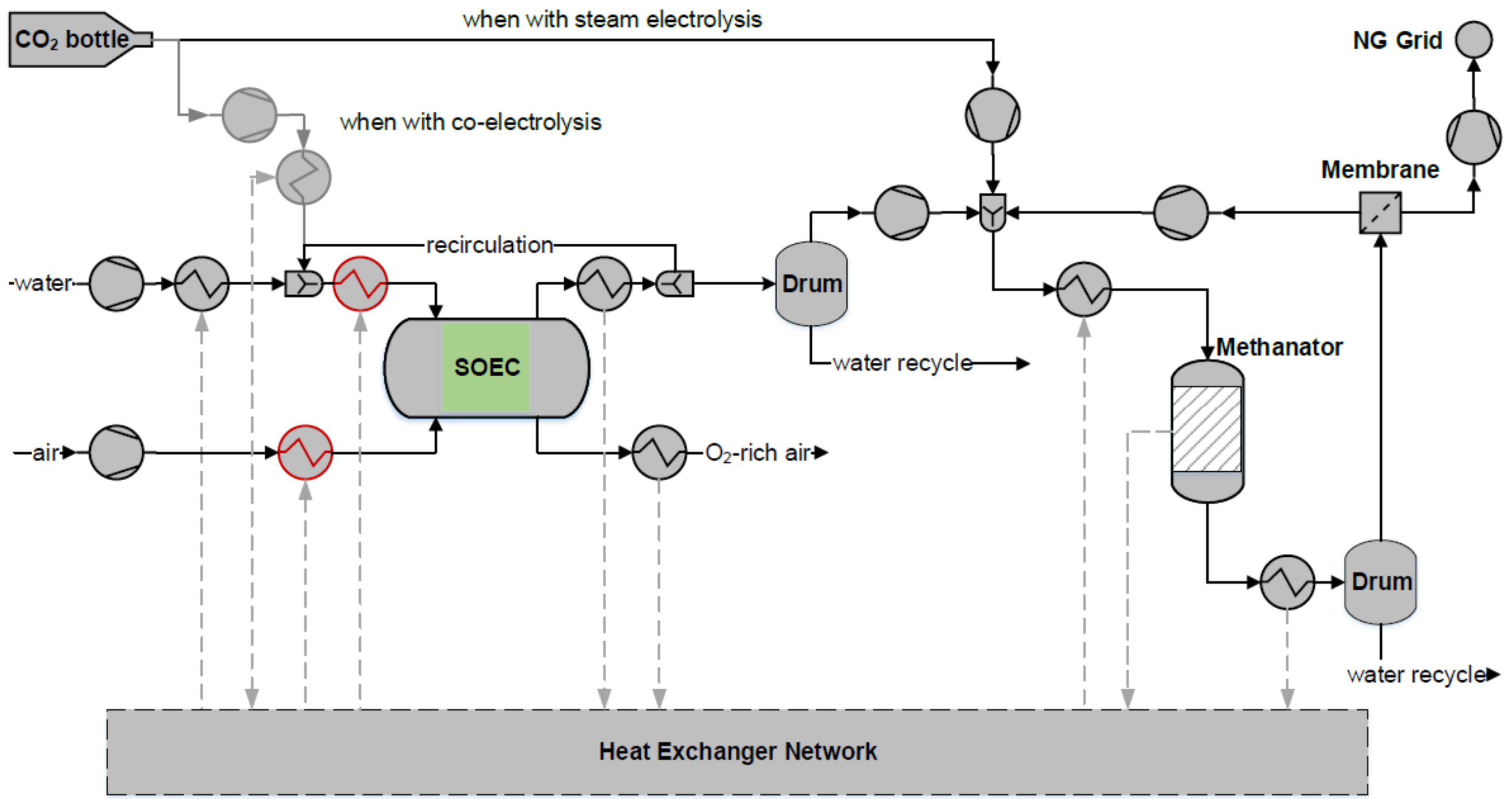
Efficient Co-Electrolyser for Efficient Renewable Energy Storage

SOEC Plant - Illustration



SOEC Plant - Simulation



L. Wang, M. Perez Fortes, H. Madi, S. Diethelm, J. Van herle, F. Maréchal, *Optimal design of solid-oxide electrolyzer based power-to-methane systems: A comprehensive comparison between steam electrolysis and co-electrolysis*, Applied Energy, 2017, revision submitted.

SOEC Plant - Major Findings

- **Trade-off between the system efficiency and methane production rate:** Due to the nature of electro-chemical splitting, pursuing larger methane production can result in a reduction of system efficiency.

- **Better system-level heat integration by co-electrolysis operation:** With the practical reactant utilization from 60% to 80%, the co-electrolysis case can achieve heat self-sufficiency for steam generation, leading to a higher efficiency than the steam-electrolysis case under identical conditions, and may reject certain heat, which is possible to be recovered for a further efficiency improvement

- **Exothermic operation potential for capacity boost of a fixed hardware:** The increase of temperature inside the electrolyzer allows to accept more current thus increasing the methane production at almost no cost of system efficiency.

- **Several heuristics derived:** As long as the air as sweep gas, pressurized operation of the electrolyzer is not preferred. Methanation pressure depends highly on the system-level heat integration and is not necessarily “the higher, the better”.