

Activities in the frame of the FCH-JU

SOPHIA project overview

¹R.C. Makkus

¹*HyGear Fuel Cell Systems*

**Corresponding author e-mail address: robert.makkus@hygear.com*

Hydrogen and other fuels are expected to play a key role as energy carrier for the transport sector and as energy buffer for the integration of large amounts of renewable energy into the grid. Therefore the development of carbon lean technologies producing hydrogen at reasonable price from renewable or low CO₂ emitting sources like nuclear is of utmost importance. High temperature steam electrolysis (so-called HTE or SOE for Solid Oxide Electrolysis) presents a major interest, since less electricity is required to dissociate water at high temperature, the remaining part of the required dissociation energy being added as heat, available at a lower price level. In addition, technologies that offer the possibility not only to transform energy without CO₂ emissions, but even to recycle CO₂ produced elsewhere are rare. High temperature co-electrolysis offers such a possibility, by a joint electrolysis of CO₂ and H₂O, to produce syngas (H₂+CO), which is the standard intermediate for the subsequent production of methane or other gaseous or liquid fuels after an additional processing step. The project SOPHIA covers these aspects. A 3 kWe-size pressurized HTE

system, coupled to a concentrated solar energy source is designed, fabricated and operated on-sun for proof of principle. Second, the concept of co-electrolysis at the stack level while operated also pressurized has been proven. Further, SOPHIA has identified different “power to gas” scenarios of complete process chain (including power, heat and CO₂ sources) for the technological concept development and its end-products valorisation. A techno-economic analysis has been carried out for different case studies identified for concepts industrialization and a Life Cycle Analysis with respect to environmental aspects according to Eco-indicator 99 will be performed. The presentation provides a short overview of all developments within the project.

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