Reversible solid oxide Electrolyzer and Fuel cell for optimized Local Energy miX

Objectives

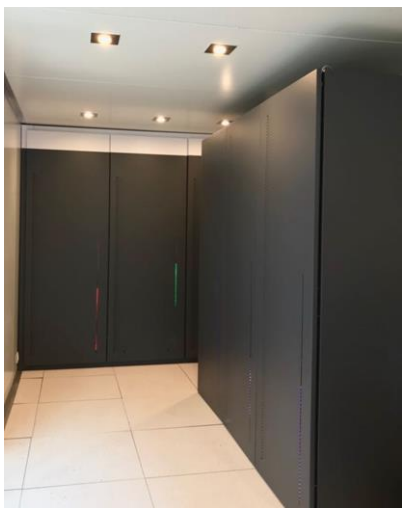
The REFLEX project aims at developing an innovative renewable energies storage solution, the "Smart Energy Hub", based on reversible Solid Oxide Cell (rSOC) technology, able to operate either in electrolysis mode (SOEC) to store excess electricity to produce H_2, or in fuel cell mode (SOFC), when energy needs exceed local production, to produce electricity and heat again from H_2 or any other fuel locally available. The challenging issue of achieving concomitantly high efficiency, high flexibility in operation and cost optimum is addressed through improvements of rSOC individual components and system, and the definition of advanced operation strategies.

Power electronics induce losses, generally around 5% at near vicinity of the nominal point, that rapidly increase as system evolves away the nominal point. The operation at high currents and low voltages as well as with large power modulations requires work on power electronics to enlarge the high efficiency domain in all operating modes. A global control system is developed for the set of storage systems with the help of power electronics devices.

System design

The overall Smart Energy Hub design has been defined, with an electrical architecture selected among several possible options to maximize the electrical efficiency in all operating modes. The electrical components have been selected, purchased/or manufactured. The thermal management components have been specified as well.

Various scenarios for the demonstration at Envipark have been defined, taking into account production and consumption profiles.



Power electronics and storage system developments

DC-DC converters & Battery system

- DC-DC converters: >90% Hi-efficiency reversible power electronics converters allow the injection of low DC voltage from the rSOC [34-68 V] to the Hi-Voltage bus [380 V] and, in the reverse operation; the converters inject the power from the Hi-Voltage bus to the rSOC to produce Hydrogen.

- Battery Storage System: >50kWh Li-Ion energy storage system in a compact 42U height cabinet working as backup energy system.

DC-AC converters

DC AC Converters: A turn-key bidirectional Power converter to integrate a Li-Ion battery and an autonomous Power Converter to connect the DC bus created by DCDCs Power Converters of the Fuel Cells to the AC main grid.

The REFLEX project – www.reflex-energy.eu
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