Improved performance and reliability of hydrogen electrolysers

ELHySE project — Pays de la Loire

CIFRE thesis: Company COMECA, Le Mans — IREENA lab, Saint-Nazaire
Démarrage : 09/01/2022

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Subject — To answer the upcoming global transition to a carbon-free society, hydrogen is proving to be a promising vector for the future. The commitments made by the European Commission go in this direction by targeting an installed hydrogen production capacity of at least 6 GW by 2024, and then reach more than 40 GW by 2030. This ramp-up is intended to be gradual, initially targeting the production of hydrogen from electrical energy from the European grid, without distinction as to the origin of this energy in order to allow the industrial maturation of the H2 ecosystem. A second phase will then consist in promoting the production of fully decarbonized hydrogen by backing it up in particular with renewable energy production solutions, such as wind, photovoltaics or biogas production.

COMECA, located in Le Mans, has been developing high-power electrical energy conversion solutions for more than 10 years. A large part of the targeted applications concerns the charging and discharging of stationary or on-board electrochemical batteries, with power interfaces ranging from a few tens of kW to MW. Very recently, and due to the new European and national directives, the market around hydrogen production is growing, and in particular in the development and implementation of electrolyzer-based solutions. It turns out that comeca has all the necessary skills to develop operational solutions for the interfacing of these stationary electrolysers with the distribution network, on a wide range of powers. Nevertheless, there are still a number of unknowns about the long-term behaviour of these devices. It therefore seems important for manufacturers and integrators of such solutions to have means of monitoring the state of health and performance of Electrolysers, in order to have on the one hand a real feedback of experience, and on the other hand to be able to anticipate certain defaults and thus contribute to the implementation of preventive maintenance tools.

The objective of the project is to seek solutions for monitoring and monitoring the health status of high-power electrolysers, relying as much as possible on the degrees of freedom offered by the power converter itself, in order to be as intrusive as possible, while remaining as close as possible to the heart of the electrochemical reaction. IREENA's expertise in the field of modeling and diagnosis of complex electrochemical organs, combined with COMECA's competence in power electronics and their system integration, will lead to new and original solutions in monitoring the state of health of these high-power devices.

keywords: diagnostics, power electronics, hydrogen, electrolyzer, control

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