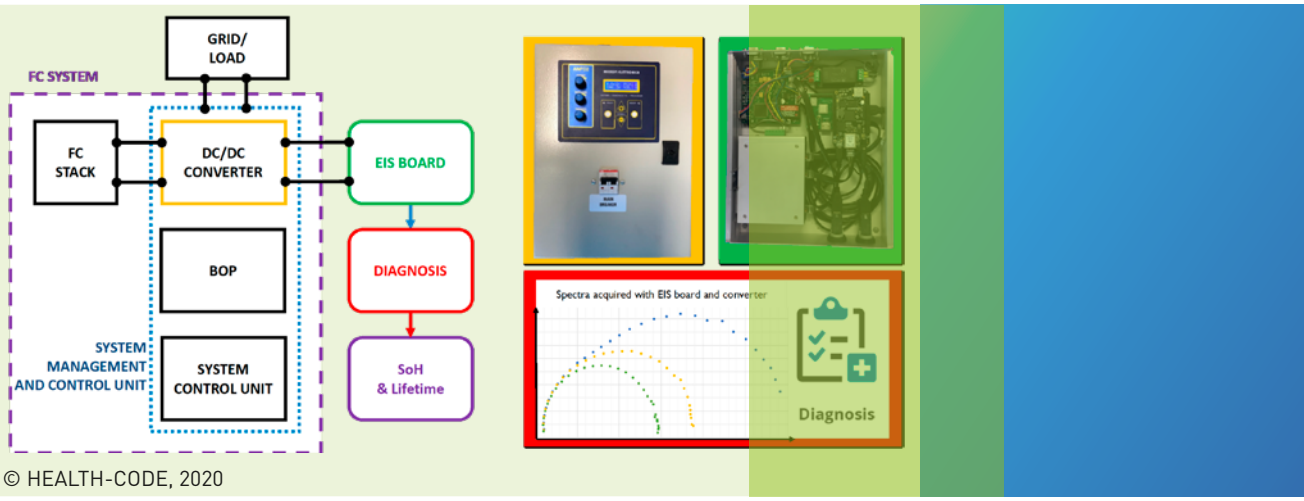
Making an impact on the clean energy transition

ENERGY

ADVANCED TOOLS FOR BETTER-PERFORMING STATIONARY FUEL-CELL SYSTEMS



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Early diagnosis, lower costs

Stationary proton-exchange membrane (PEM) and solid-oxide fuel cells could increase their market appeal if they last longer and require less care and repair downtime. Above all, there is scope to reduce maintenance costs – currently up to 20 % of total operating expenditure – and to detect and fix faults faster.
In the INSIGHT project, researchers have developed IT-based tools that can be fitted into SOFC micro combined-heat-and-power (μCHP) systems to detect early-stage critical faults and weak stack components, using electrochemical impedance spectroscopy (EIS)-based tools to propose mitigation strategies.
In parallel, the HEALTH-CODE project has designed an EIS-based monitoring and diagnostic tool to identify faults that impact the performance of micro combined-heat-and-power (μCHP) and back-up power PEM systems. Hardware and software for implementing the tools in commercial systems were developed by embedding all functions in a unique box linked to the main fuel-cell system controller. All tools can estimate a unit's remaining useful lifetime and operate with the aforementioned advanced techniques, in addition to conventional diagnostic tools. They build on results from the GENIUS, DESIGN, DIAMOND and D-CODE projects and use entirely European technology.

A series of projects funded by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) have developed IT-based tools that monitor the health of fuel-cell stacks and quickly detect and isolate faults. The technologies will make stationary fuel-cell systems more reliable and easier to maintain, to drive increased uptake of clean, on-site power generation.

Wider applications

Building on the work to date and on physical boards developed by INSIGHT and HEALTH-CODE, a follow-up project, RUBY, is developing a generic monitoring and diagnostic tool that can operate with both solid-oxide and PEM fuel-cell systems, for broader roll-out. Another follow-up project is being considered to extend the EIS-based approach to other fuel-cell technologies such solid-oxide electrolyser cells and reversible solid oxide cells. Interoperable tools also increase the possibility of standards for such technologies, enhancing access to fuel cells. A HEALTH-CODE exploitation analysis has identified transport as one sector with much to gain from EIS-based monitoring and early fault diagnosis.

ADVANCED TOOLS FOR BETTER-PERFORMING STATIONARY FUEL-CELL SYSTEMS

INCREASE FUEL-CELL APPEAL

Longer-lasting, high-quality stationary fuel cells that are cheaper to maintain could encourage more consumers to adopt low-carbon power generation.

OPTIMUM POWER PRODUCTION

Approach: Industrial and research partners have developed advanced monitoring, diagnostic, control and lifetime assessment tools for stationary fuel cells. **The goal?** To detect faults faster and earlier than current technology so that systems operate closer to their nominal conditions and last longer. **Key results?** A range of EIS-based tools that could streamline maintenance, reduce ownership costs and improve the performance and lifetime of diverse fuel-cell systems, increasing their market appeal.

KEY ACHIEVEMENTS

INSIGHT

3 TOP FAULTS
identified for solid-oxide fuel cells

10 % EARLIER
detection of fuel starvation during operation

1 TOOL BOARD
holding software and hardware innovations installed on a micro CHP fuel cell unit for validating real conditions

HEALTH-CODE

6 KEY FAULTS
detectable using the tool

4 ALGORITHMS
developed to identify faults

1 DIAGNOSTIC BOX
for µCHP and back-up systems

IMPACT

INSIGHT

BETTER UNDERSTANDING
of faults and their impact on stack lifetime

TAILORED MONITORING
of the most critical faults

COMMERCIAL APPLICATION
validated in a marketed µCHP system

HEALTH-CODE

EXPLOITABLE RESULTS
for research and early system-status detection

LONGER-LASTING, MORE RELIABLE
PEM fuel cells for wider appeal

HIGH TECHNOLOGICAL READINESS
encouraging commercial investment

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FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

A partnership dedicated to clean energy and transport in Europe

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