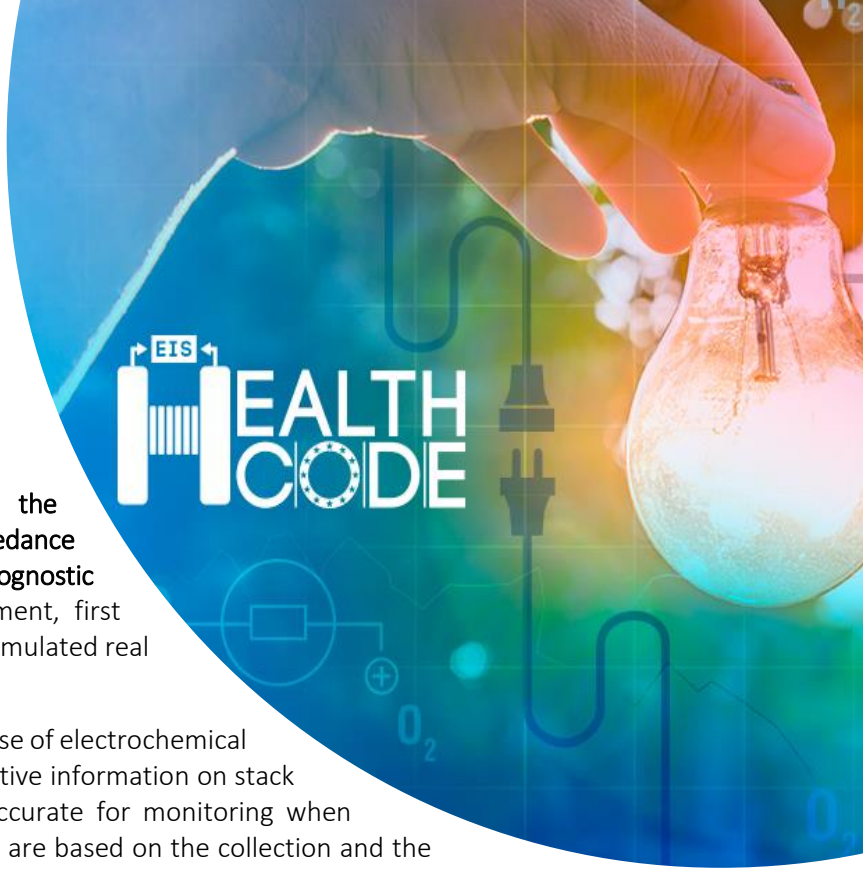
- Public Abstract -

Deliverable D2.1

Technical specifications and test procedure



The HEALTH-CODE project focuses on the development of an Electrochemical Impedance Spectroscopy (EIS)-based diagnostic and prognostic tool to be validated in laboratory environment, first under controlled conditions and then under emulated real operation.

The main technique proposed, which makes use of electrochemical impedance spectroscopy (EIS), provides effective information on stack electrochemistry. These results are more accurate for monitoring when compared to conventional techniques, which are based on the collection and the processing of several indirect measures (i.e. voltage, current, temperature, pressure, etc.).
With the objective of developing a tool that should be implementable in any system, attention will be given to the problem of making it as general as possible, which in turn entails its easy and cheap customization. It is worth remarking that future straightforward implementations are also envisaged for APU, mobile and automotive systems, and other electrochemical devices (batteries, electrolysers) which may embed the tool for monitoring and diagnosis.

HEALTH-CODE will face the challenge of delivering a monitoring and diagnostic tool able to evaluate the current state of health of a Proton Exchange Membrane Fuel Cells (PEM FCS) and to detect faults as well as forthcoming failures. The application will focus on stationary PEM FCS for µ-CHP (1 kW) and backup (3 kW) applications, equipped with different stacks and running under real operating conditions.

The project deals with 5 major faults:

- Water management (drying, flooding)
- Fuel quality change (contaminants)
- Sulfur poisoning
- Fuel Starvation
- Oxidant starvation.

Dedicated diagnostics algorithm will be developed on the basis of the acquired EIS data and test results will support the development and tuning of the Hardware dedicated to the final device.
This document aims at creating a Test Protocol for PEMFC stacks (UPS and µCHP use) in order to create valuable data for training diagnosis algorithm to be embedded on a final real-time diagnostic tool dedicated to the previously mentioned technologies.
In order to assure reproducibility and laboratory interoperability, this test protocol has been based on the exploitation of previous FCH JTI projects dealing with PEM stack testing characterization and EU standardisation (ref 1-5) and it has been adapted to H-CODE project purposes through the exploitation of partners' expertise (ref 6).

This document has been approached and structured in two parts: Procedure and Instructions, with attention to an industrial point of view:
In the *Procedure*, a general explanation of the testing technique, constraints and scope of the measurement is described, and the *Instructions* give the operational features, specifications and tools to perform, at Lab level, the stack characterization/investigation and the data collection, respecting technology features and constraints. **The general standardized industrial approach describes a methodology, which can be used for the characterization and investigation of every kind of electrochemical device (batteries, FCs, electrolysers, etc.).**