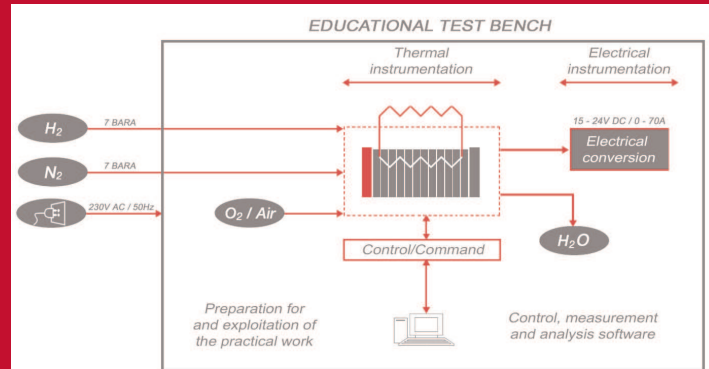


BAHIA didactic fuel cell system

HELION, part of AREVA Group, provides for higher education a complete didactic fuel cell system, developed in partnership with teachers of IUT of Marseille, Ecole Polytechnique and Ecole des Mines.

This system contains:

- > An industrial didactic bench employing a 1 kW_e and 1 kW_{th} fuel cell,
- > A friendly man-machine interface comprising:
 - An operation simulator of fuel cell system,
 - Training materials and results analysis of practical work.



>> BAHIA overview

« BAHIA is an EC-certified didactic bench, integrating a PEM (Proton Exchange Membrane) fuel cell stack, rated to 1 kW electrical power and 1 kW thermal power, enabling micro cogeneration investigation.

It provides fully integrated applications to ensure a large variety of experiments in a safe mode, meeting higher education requirements. »

Technical characteristics:

Dimensions

- Height: 1 m
- Length: 0.6 m
- Width: 0.6 m
- Process module mass: 62 kg
- Electrical module mass: 47 kg

Performances

- > Electrical Power
 - Nominal power: 500 W ($U = 23 \text{ V} / I = 22 \text{ A}$) to 1000 W ($U = 20 \text{ V} - I = 50 \text{ A}$)
 - Maximum power: 1200 W ($U = 19 \text{ V} - I = 62 \text{ A}$)
- > Thermal power: up to 1 kW_{th}
- > Compact and robust fuel cell stack operating:
 - in dead-end mode on H₂ side (stoichiometry H₂ = 1.07)
 - in circulating mode on air side (stoichiometry O₂ = 1.5 à 2.5)
- > H₂ consumption
 - 5.5 NI/min at 500 W
 - 11.2 NI/min at 1000 W, enabling a 13-hour autonomy at nominal power with a B50 (8.8 m³) bottle
- > N₂ consumption
 - 8,4 NI/stop, i.e. 250 stops with a B11 (2.1 m³) bottle
- > Uninterrupted H₂-rejected equivalent flow: 1.2 l/min
- > Start up time lower than 1 minute



Installation

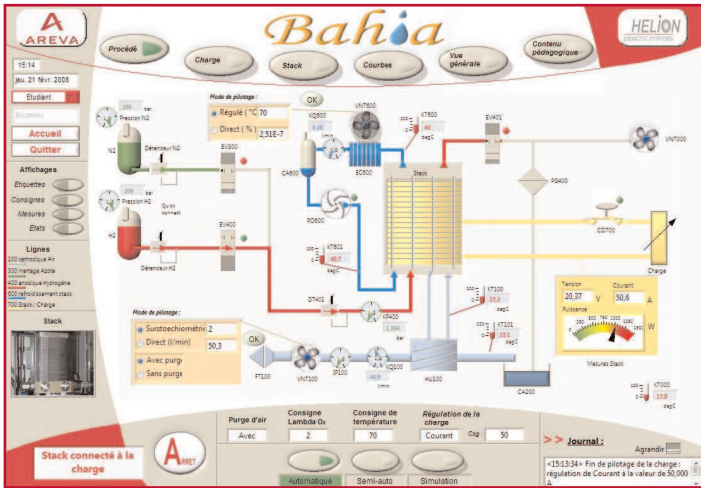
- > H₂ and N₂ supply at 7 bar pressure (H₂ and N₂ quick connect plug)
- > Electrical grid supply: 230 VAC - 50 Hz
- > Safety recommendations:
 - Minimum volume of area 15 m³
 - Ventilation 3 volumes/heure
 - A H₂ external sensor (threshold 10 000 ppm)

> The didactic bench BAHIA allows to carry out numerous practical work exercises:

- theoretical applications: polarization curves based on parameters,...
- fuel cell system applications: study of the stack and components to optimize operation of the overall
- fuel cell stack applications: control and run of miscellaneous profiles corresponding to different usages such as cogeneration performance studies, fuel cell backup power systems, transport, renewable energy for decentralised energy production, underwater applications,...

Functions and instrumentation:

> BAHIA offers a wide range of functions to study and explore fuel cells operation.



Process view

Variable parameters	Measured values	Calculated values
<ul style="list-style-type: none"> - Current, voltage, resistance and power profile - FC stack temperature profile - Air flow profile (stoichiometry) - ... 	<ul style="list-style-type: none"> - Temperatures - H₂ pressure - Water flow - Stack voltage / current - Power of auxiliaries - ... 	<ul style="list-style-type: none"> - H₂ flow - Thermal and electrical powers - Substance efficiency - Electrochemical efficiency - ...

> 3 operating modes are available during practical works and experiments:

- PC simulation: allows simulation of the fuel cell system operation from any computer
- Semi automatic mode: enabling students to break up the different system starting phases and launch miscellaneous profiles
- Automatic mode: automatic system operation (start/load profiles/stop) based on parameters defined by the user.

> 1 programming mode for educators which allows to configure the practical works parameters

>> Man-Machine Interface integrating a simulator and training materials to meet practical works requirements

Process:

Interactive process monitoring

Curves:

Real time monitoring of data and function points

Load:

Programming different electronic load profiles

Overview:

Input and output system data record as well as efficiency calculations and statistics

Stack:

FC stack performances control and run, post-analyse to display electrochemical parameters (the Tafel equation, limit current, polarization resistance ...)

Pedagogical content:

Database of practical works and courses that can be customized by instructors and teachers



>> A safe modular system
 The system obtained the EC certification, ensuring safe operation by non experienced users.

BAHIA is a project labelled by Capenergies cluster (a cluster for greenhouse gas-free energy in the PACA – Provence Alpes Côtes d’Azur and Corsica regions) and supported by FUI (a French national fund).

HELION

Domaine du Petit Arbois - Bâtiment Jules Verne - BP 71 - 13545 Aix en Provence Cedex 4 - France
 Tel: 00 33 (0)4 42 90 81 50 - Fax: 00 33 (0)4 42 90 71 97 - info@helion-fuelcells.com - www.helion-hydrogen.com