

## TOWARDS A CLEAN MOBILITY FUTURE

### INN-BALANCE OBJECTIVES

INN-BALANCE's ambition is to boost hydrogen mobility by developing a new generation of highly-efficient fuel cell Balance of Plant components. These components will add up to an innovative fuel cell system and hence greatly improve the cost, the efficiency and the reliability of fuel cell powered vehicles.

INN-BALANCE integrates the latest trends in fuel cell vehicle technology into the development of

- ◆ a new air turbo compressor;
- ◆ combined hydrogen injection and recirculation;
- ◆ advanced control and diagnosis devices;
- ◆ a new concept of thermal management.

INN-BALANCE addresses these technical developments with high focus on cost optimization and manufacturing processes. Alternative supply chains, automotive procedures and quality ranges are also considered to provide competitive components.

As the efficiency of fuel cell powered vehicles depends on all components of the system being well adjusted, INN-BALANCE also works on the smart integration of the newly developed components. Therefore, the automotive fuel cell stack, with its novel components, will finally be incorporated into a vehicle powertrain to test its drivability, durability and performance.



## INN-BALANCE PARTNERS



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For further information and to follow our project progress please visit [www.innbalance-fch-project.eu](http://www.innbalance-fch-project.eu)

## INNOVATIVE COST IMPROVEMENTS FOR BALANCE OF PLANT COMPONENTS OF AUTOMOTIVE PEMFC SYSTEMS



## INN-BALANCE AUTOMOTIVE FUEL CELL



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## BOOSTING AUTOMOTIVE FUEL CELLS COMMERCIALIZATION

### INN-BALANCE IMPACT

INN-BALANCE will not only deliver high-performance fuel cell Balance of Plant (BoP) components, but will also contribute to accelerate fuel cells commercialization for automotive application in Europe, facilitating the market take-off of H<sub>2</sub> vehicles.

- ◆ INN-BALANCE optimized BoP components will have lower production costs & longer life-cycles, increasing the technology's reliability, durability and competitiveness.
- ◆ A standardized platform of BoP components and requirements for European equipment manufacturers will be provided. On this basis, a secure and competitive supply chain, facilitating the development of consistent business concepts for Europe's automotive industry, will be established.

By developing low-cost and reliable solutions for fuel cell powered vehicles, INN-BALANCE will pave the way for hydrogen mobility gaining momentum in Europe. This will result in the creation of sustainable and highly qualified job opportunities. Altogether, INN-BALANCE achievements in improving fuel cells will benefit climate protection and energy security.

**INNovative Cost Improvements for BALANCE of Plant Components of Automotive PEMFC Systems**

**Project Duration: 2017 - 2021**

# IMPROVING AUTOMOTIVE FUEL CELLS

# MAIN PROJECT OUTPUTS

## INN-BALANCE COMPONENTS

### A THERMAL MANAGEMENT SYSTEM

#### PRIME FUNCTION

The thermal management system keeps all components of the fuel cell system at a desired temperature level and enables cold start of the fuel cell vehicle with low heat requirements.

#### INN-BALANCE IMPROVEMENTS

Implementation of a cold start procedure that allows to start the fuel cell system at temperature below the freezing point. In addition, an innovative cold start procedure with start-up capabilities of down to  $-40^{\circ}\text{C}$  based on the injection of an electrochemical active antifreeze fluid was developed and tested.

### B CATHODE MODULE

#### PRIME FUNCTION

Supply a desired mass flow of oxygen ( $\text{O}_2$ ) at a particular reference humidity to the fuel cell stack.

#### INN-BALANCE IMPROVEMENTS

Implementation of a highly efficient turbo compressor with gas-bearings and associated power electronics ensuring highest efficiency in all operating points.

Turbo compressor and associated power electronics  
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### C ANODE MODULE

#### PRIME FUNCTION

Provide hydrogen ( $\text{H}_2$ ) to the fuel cell stack. Unused hydrogen is recovered and recirculated to increase the hydrogen utilization rate.

#### INN-BALANCE IMPROVEMENTS

Implementation of a passive recirculation system that leads to a higher efficiency of the anode module.

In order to save place, some components were directly integrated into the fuel cell stack pod.

### D CONTROL SYSTEM

#### PRIME FUNCTION

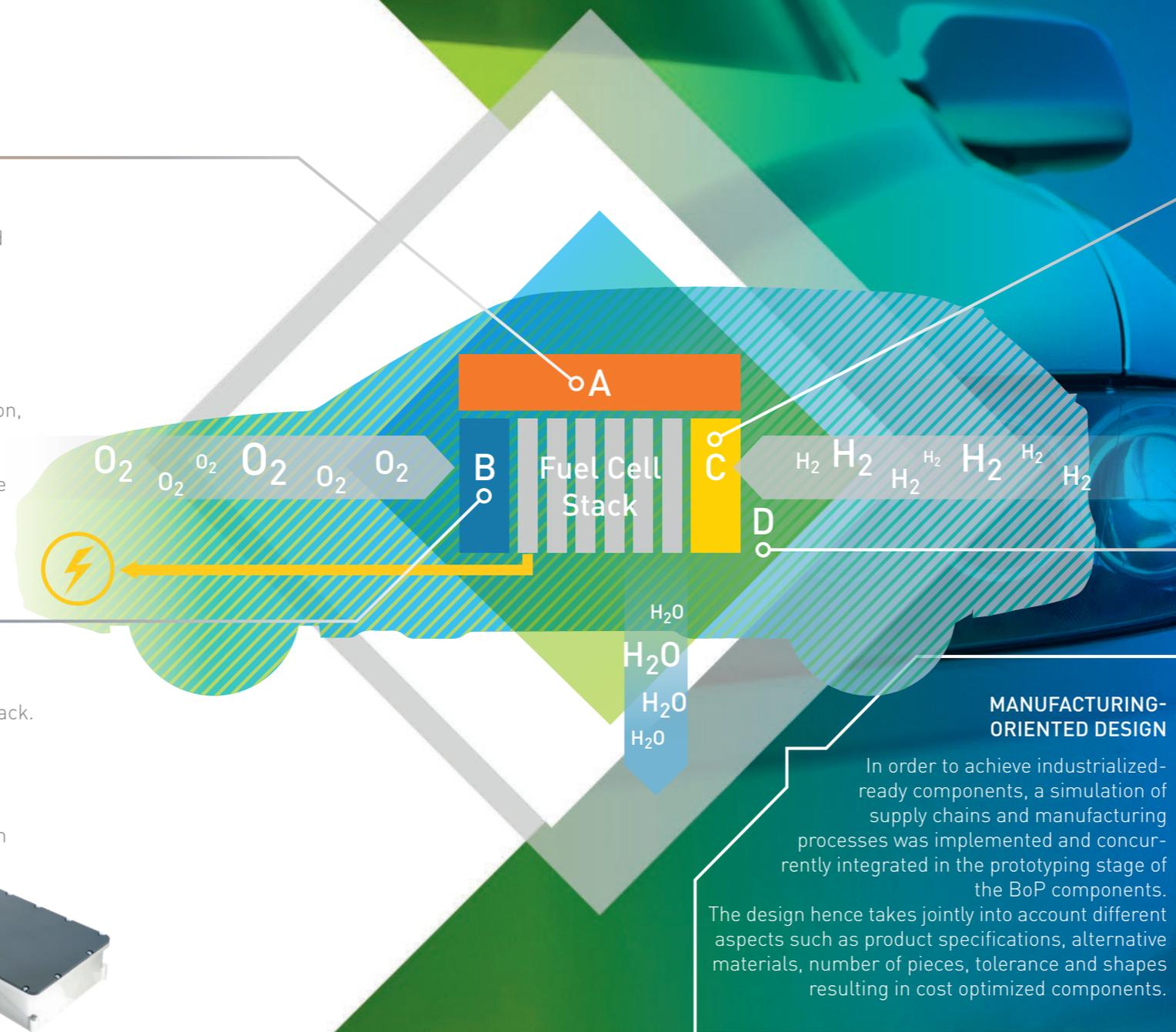
Ensure smooth running of the fuel cell system and prevent and eliminate as soon as possible any source of disturbance.

#### INN-BALANCE IMPROVEMENTS

Implementation of an innovative non-intrusive diagnosis system that predicts changes indicating developing fault. This leads to a better performance and increased durability of the fuel cell system.



THDA diagnosis system  
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### MANUFACTURING-ORIENTED DESIGN

In order to achieve industrialized-ready components, a simulation of supply chains and manufacturing processes was implemented and concurrently integrated in the prototyping stage of the BoP components.

The design hence takes jointly into account different aspects such as product specifications, alternative materials, number of pieces, tolerance and shapes resulting in cost optimized components.