



Making an impact  
on the clean  
energy transition

TRANSPORT

# STACKING THE ODDS IN HYDROGEN'S FAVOUR



## The incredible lightness of hydrogen

The transport sector accounts for almost a quarter of Europe's greenhouse gas emissions and causes most of the air pollution in cities. While hydrogen fuel cells can help achieve the EU's 2050 climate-neutral goal, they need to be produced in greater quantities, to strict quality standards, and at lower cost. To get there, the DIGIMAN and Fit-4-Amanda projects increased automation in the manufacturing process and simplified the design of fuel cell stack parts. DIGIMAN has taken a proton exchange membrane (PEM) fuel cell production line from semi- to full automation. The Fit-4-Amanda consortium built a scalable mass-manufacturing machine. Projects such as INLINE and INN-BALANCE assessed current manufacturing processes and redesigned several components to enable easier production.

## One step closer to mass production

The FCH JU has invested EUR 31 million in eight complementary manufacturing projects that bring together research institutes, universities and vehicle makers to ensure that manufacturing improvements are commercialised. The blueprint for a fuel cell assembly production line developed by DIGIMAN allows production to be scaled up to 50 000 fuel cell stacks per year. The project raised the design's manufacturing readiness (MRL) to level 6, the pre-production stage. Meanwhile, the project consortium is continuing to disseminate the results of its work.

**Vehicles powered by clean, efficient hydrogen fuel cells can make a vital contribution to reducing greenhouse gases and pollution. Several FCH JU-funded projects are developing the technology to mass produce cell stacks in response to market demand, while ensuring they meet strict quality standards.**



FCH JU Success Stories

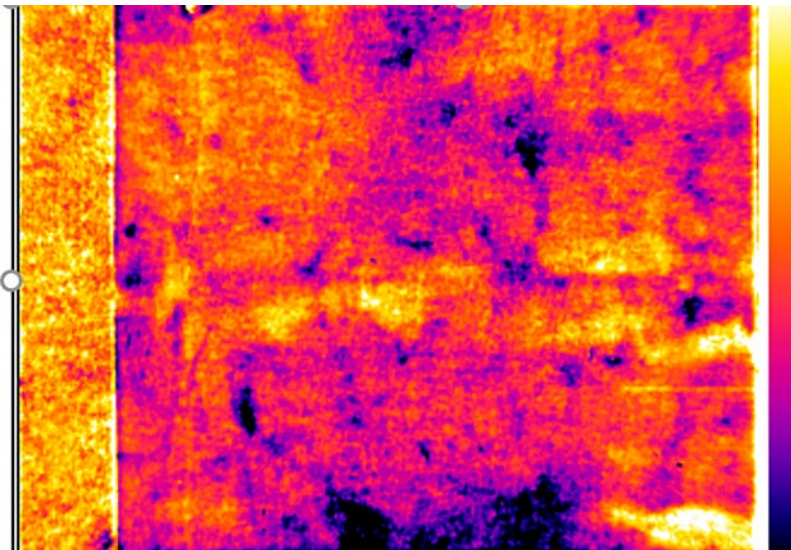


**MORE, BETTER, FASTER**

To meet the growing demand of zero-emission vehicles, fuel cell stack production capacity has to increase from tens of thousands of units per year to hundreds of thousands, along with millions of components. Quality control methods to identify flaws that could affect stack performance need to be integrated into production.

**BRIDGING THE GAP**

The fuel cell market is making the transition from time-consuming manual, laboratory-based manufacture to mass production. These projects are helping to bridge this gap by developing scaleable, adaptable production technology that European manufacturers can add to as demand increases, avoiding the need for massive initial investments. Reducing the waste of materials, integrating quality control into production to save time, and simplifying the design of stack components is part of this process. **The goal?** To accelerate commercialisation of fuel cells for vehicles by improving manufacturing processes and lowering production costs. **Key results?** Digitised and automated production, in line with Industry 4.0 standards, has improved the design and performance of fuel stack parts and made it easier to determine the relationship between the two. This has provided a basis for further scientific and technical progress. The fuel cell manufacturing supply chain has been improved and DIGIMAN project partner Intelligent Energy now has a better production line, enabling greater output of PEM fuel cells.



© CEA, IE, FRE, 2019

**KEY ACHIEVEMENTS**

**50 000**

fuel cell stacks per year can be manufactured by DIGIMAN's blueprint for a fully automated production line

**4**

companies, one of which is an SME, are introducing innovations, thanks to DIGIMAN

**5 SECOND**

cell assembly time achieved by DIGIMAN, down from 22 seconds

**ELIMINATION OF OPERATOR HEAD COUNT**

from 4 to none, as the DIGIMAN cell assembly process has been raised from semi- to fully automated

**IMPACT**

**PRE-PRODUCTION READINESS**

or manufacturing readiness level 6, achieved by the DIGIMAN production line design

**FIVE-FOLD**

improvement in cell assembly time at DIGIMAN project partner Intelligent Energy

**IMPROVED CHARACTERISATION**

of the gas diffusion layer with the use of inline quality control hardware and big-data techniques

**STRONGER**

supply chain for the fuel cell manufacturing market, especially for DIGIMAN partners Intelligent Energy and Freudenberg

**SEAMLESS INTEGRATION**

of digital manufacturing techniques with advanced automated production technology achieved by DIGIMAN

FIND OUT MORE



[www.fch.europa.eu/page/fch-ju-projects](https://www.fch.europa.eu/page/fch-ju-projects)  
<https://digiman.eu/>  
<https://fit-4-amanda.eu/partners/>  
<https://www.inline-project.eu/>  
<https://www.innbalance-fch-project.eu/>



@fch\_ju



**FUEL CELLS AND HYDROGEN  
JOINT UNDERTAKING**

A partnership dedicated to clean energy and transport in Europe