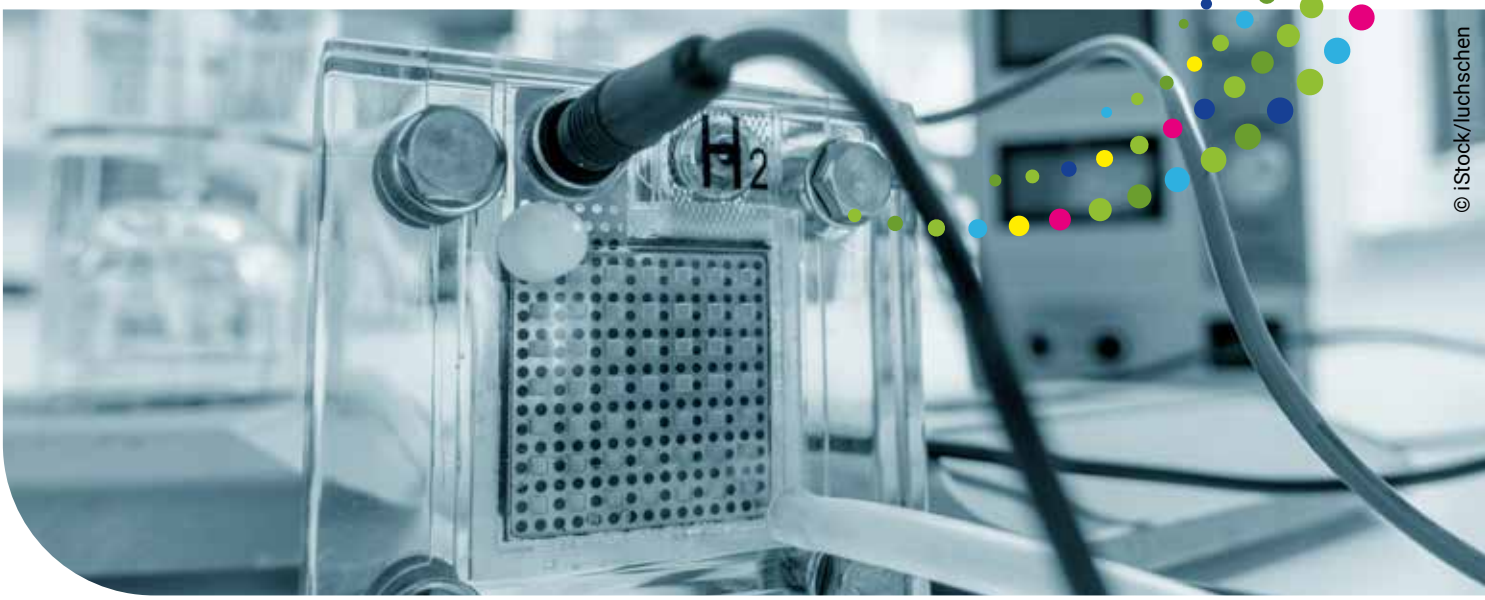
Clean Hydrogen Partnership

Hydrogen End-uses

An important step for fuel cell membrane technology



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Fuel cell stacks are the heart of power production in electric vehicles. The GAIA project, funded by the Clean Hydrogen Partnership developed and tested advanced fuel cell components that can satisfy stringent durability and performance requirements, taking the technology another step closer to commercial deployment.

The sum of the parts

The membrane electrode assembly (MEA) is the key part of the fuel cell where the chemical reactions that produces electricity from hydrogen fuel take place. Its components make up to 60 % of the total fuel cell cost. The use of innovative materials in MEAs is improving their performance and reducing production costs.

GAIA succeeded in increasing the power density of its high-performance MEAs by 20 % compared to the state-of-the art, meeting the 2024 Clean Hydrogen Partnership power density target for light-duty vehicles of 1.8 W/cm^2 at 6V.

It did so without increasing the amount of platinum on the catalyst. Previous projects like VOLUMETRIQ improved manufacturing technology and quality assurance for fuel cell stack components, while INSPIRE integrated stack components that can meet performance, durability and cost targets into a fuel cell.

Partnerships for success

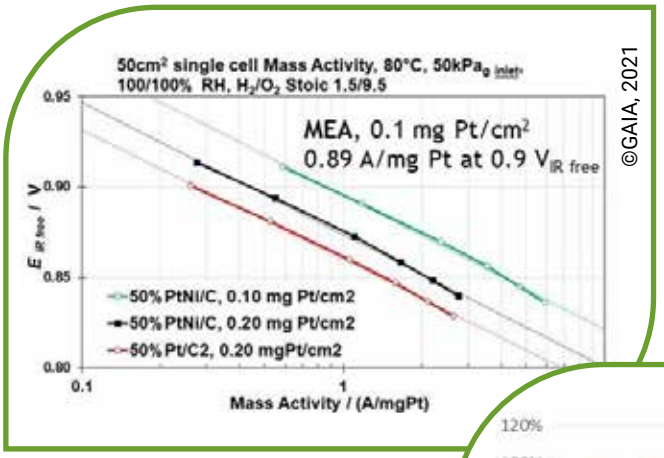
GAIA brought together 10 partners including research institutions, a leading multinational vehicle manufacturer and manufacturers of fuel cells and advanced materials like nanofibers. The MEAs developed were tested in a 4-cell stack. The project results were communicated to industry, academia, government bodies and the public. In the future, the project achievements will be validated in a larger 10-cell stack and over 6 000 hours of operation. The techno-economic feasibility of the MEA will be assessed, targeting a cost of EUR 6/kW, in line with the call topic.

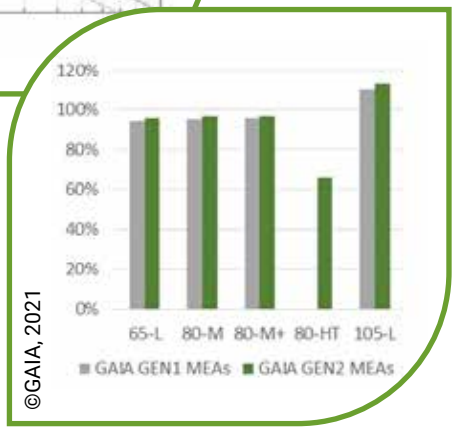
MORE PERFORMANCE, LESS COST

To ensure the commercial viability of the technology, the longevity of MEA components needs to be improved and the high cost of manufacture, due to the use of a platinum catalyst, must be reduced.

A FOCUSED APPROACH

The advances were achieved thanks to coordinated research and innovation into MEA design and catalysts, ionomers, membranes and gas diffusion layers by industry, manufacturers and academia. **The goal?** To achieve increased power density, which will lower overall stack cost, in turn helping to support the large-scale adoption of proton exchange membrane fuel cell technology and decarbonise the transport sector. **Key results?** The European Commission's Innovation Radar determined that the power density achieved by GAIA's MEAs has market-creating potential. A cost analysis determined that recycling of catalysts and ionomers could significantly reduce MEA cost, bringing it close to the EUR 6/kW target of the public-private partnership's 2019 annual working plan.





KEY ACHIEVEMENTS

1.8 W/CM²
power density target achieved, at 0.6 V

20 %
increase in power density over state-of-the art

0.25 G PT/KW
of platinum-specific power density, reduced from 0.45g Pt/kW achieved by VOLUMETRIQ

11 μV/H AND -14 μV/H
degradation rate target achieved for the catalyst at various stack temperatures and current densities

8
articles published to date in international high-quality journals

IMPACTS

STRONGER
leadership of fuel cell technology thanks to progress achieved by GAIA

NEW MEA MATERIALS
developed and up-scaled by GAIA

FIRST TIME
use of an up-scaled electrospun reinforcement in the membrane used for the MEA in final stack testing

EXTREMELY LOW
degradation rate of catalyst and gas diffusion layers achieved

REPRODUCIBLE
power density achievement demonstrated in two full-size automotive MEAs

EXCELLENT PROGRESS
made towards durability and cost targets

SIGNIFICANT REDUCTION
of MEA cost possible with recycling of catalysts and ionomers

FIND OUT MORE

Clean Hydrogen Partnership
The GAIA project
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Co-funded by the European Union

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