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Improved electrolysis for distributed hydrogen production

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High Performance PEM Electrolyser for Cost-effective Grid Balancing Applications



HPeM2GAS - Deliverable report

**D5.2 Final design of a low cost PEM electrolyser system
and safety study on simplified BoP**

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Publishable summary

The next generation water electrolyzers must achieve better dynamic behaviour (rapid start-up, fast response, wider load and temperature ranges) to provide superior grid-balancing services and thus address the steep increase of intermittent renewables interfaced to the grid. The HPEM2GAS project aims to develop a low cost polymer electrolyte membrane (PEM) water electrolyser optimised for grid management through both stack and balance of plant innovations, culminating in a six month field test of an advanced 180 (nominal) - 300 kW (transient) PEM electrolyser. The electrolyser developed will implement an advanced balance of plant and improved stack design and components, which will contribute significantly to reducing the electrolyser CAPEX and OPEX costs.

As part of the project, a new low cost balance of plant has been designed. A comprehensive review of the current state of the art for an electrolyser system has been undertaken with the objective of simplifying the system, without compromising safety, durability and operability. A new process and instrumentation diagram (P&ID) and Equipment, Valve and Instrument lists have been generated. Also, a new control logic flow diagram has been produced describing how the new system will operate in both automatic and manual modes, to control all the safety systems and manage system shut downs in the event of a malfunction.

Higher system operating temperatures enable an increase in efficiency and a lowering of both the capital and operating costs, however the durability of commercially available ion-exchange resins used to maintain water purity currently limits this. This report also summaries the work undertaken to synthesize and test innovative Aquivion-based ion-exchange resins for water purification, with an extended operating temperature range.