



AVL Electrolyzer System Monitoring & Testing Solutions

Accelerating the Deployment of Green Hydrogen Production

Towards a Sustainable Future

Hydrogen is widely recognized as a promising energy vector to replace fossil fuels. However, to establish hydrogen as the backbone of our energy infrastructure, a significant ramp up in technological readiness and deployment of large-scale electrolysis systems is required.

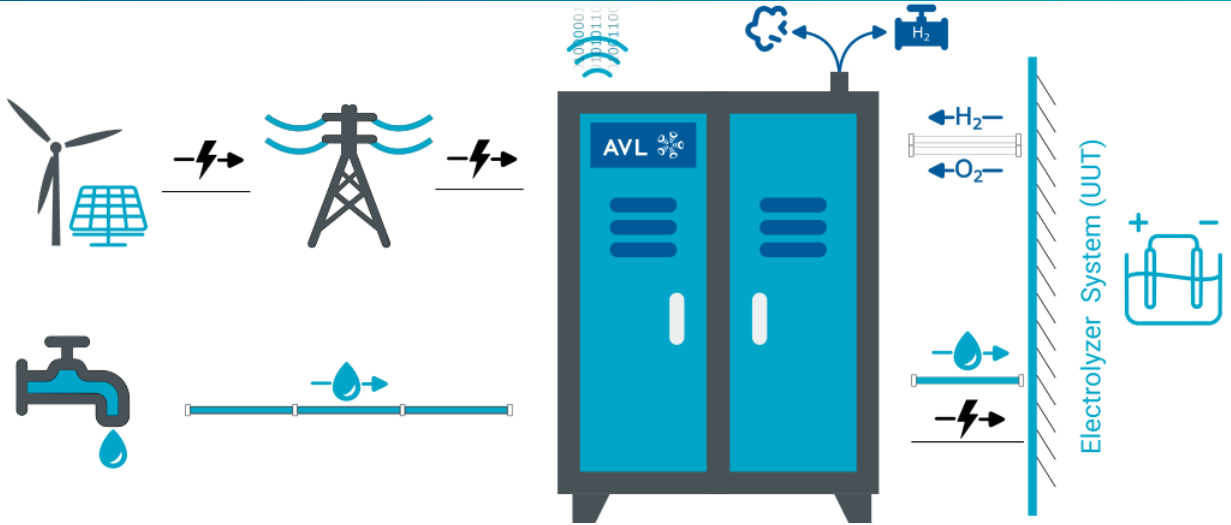
The industrialization of water electrolysis systems however does pose significant challenges:

- Most of the research is based on cell & stack whereas the scaleup into large scale (i.e. multi-Megawatt) systems is often underestimated
- Factory Acceptance Tests (FAT) and calibration of operation and control strategy is often done on site, which leads to significant development risks
- Independent validation and verification as well as long-term operational monitoring required to improve robustness and overall efficiency is not commonly established

Testing on a System Level

Our electrolysis system monitoring and testing solution is a containerized and flexible development and testing platform that allows to front-load engineering tasks and unlock the full potential of electrolysis systems before it's application in the field. Following key-tasks can be realized for unit-under-test in the megawatt range:

- Factory acceptance testing and KPI assessment
- Independently validating and verifying performance and engineering targets of electrolysis systems
- Operation strategy and control software optimization and calibration
- Augmentation and extension of data with AVL's proven data analytics and system simulation tools
- Interface emulation and conditioning (e.g. back-pressure, thermal conditioning, grid emulation)
- Safe handling of product gases (H₂, and O₂)



Functional Description

- Energy efficiency and gas production characterization
- Fit-for-Function testing for different application scenarios (e.g. dedicated H₂ production in a chemical plant environment vs. power-to-power plant for grid stabilization)
- Determining operational and start-up characteristics as well as transient ramp up or load-following behavior
- Automation of testing procedures and protocols as well as data handling, processing and storage.
- Determining the concentration of product gases as well as interface capabilities and sampling lines for additional gas quality analysis equipment.
- The safe handling, dilution, and ventilation of product gases, when not connected in a productive environment
- Feed water consumption measurement and conductivity monitoring
- Thermal load measurement to external cooling system.

The AVL Difference

AVL's electrolyzer system monitoring and testing solution is a first of its kind on the market enabling the characterization and testing of water electrolysis products on a system level in the megawatt range. Upfront testing of electrolysis systems reduces the development risks and allows for additional engineering loops and product optimization before installation and commissioning on-site of customers. Well-established test environments and procedures improve the overall robustness and efficiency and helps to reduce time to market for new electrolysis system developments.

Benefits at a Glance:

- **For OEMs:**
Improve robustness and mitigate risks by extensive testing, validation and optimization before final commissioning on-site
- **For Plant Operators:**
Remotely monitor gas quality and state of operation independent from the electrolysis systems internal sensors
- **For Certifying Bodies:**
Use AVL's monitoring and testing solution as an independent third-party tool to verify electrolysis system products. Our containerized solution is transportable and can be shipped on site where needed.

AVL as Your Partner

By establishing AVL as your trusted partner for your testing needs, you also gain access to our vast network of engineers and experts. We do not only know how to test but why to test. We are happy to support throughout the complete development process and help make your vision reality!

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