



Hydrogen Production Technologies

Simulation – Engineering – Testing. For Sustainable Solutions. For Present and Future.

INNOVATION FOR SUSTAINABLE ENERGY STORAGE

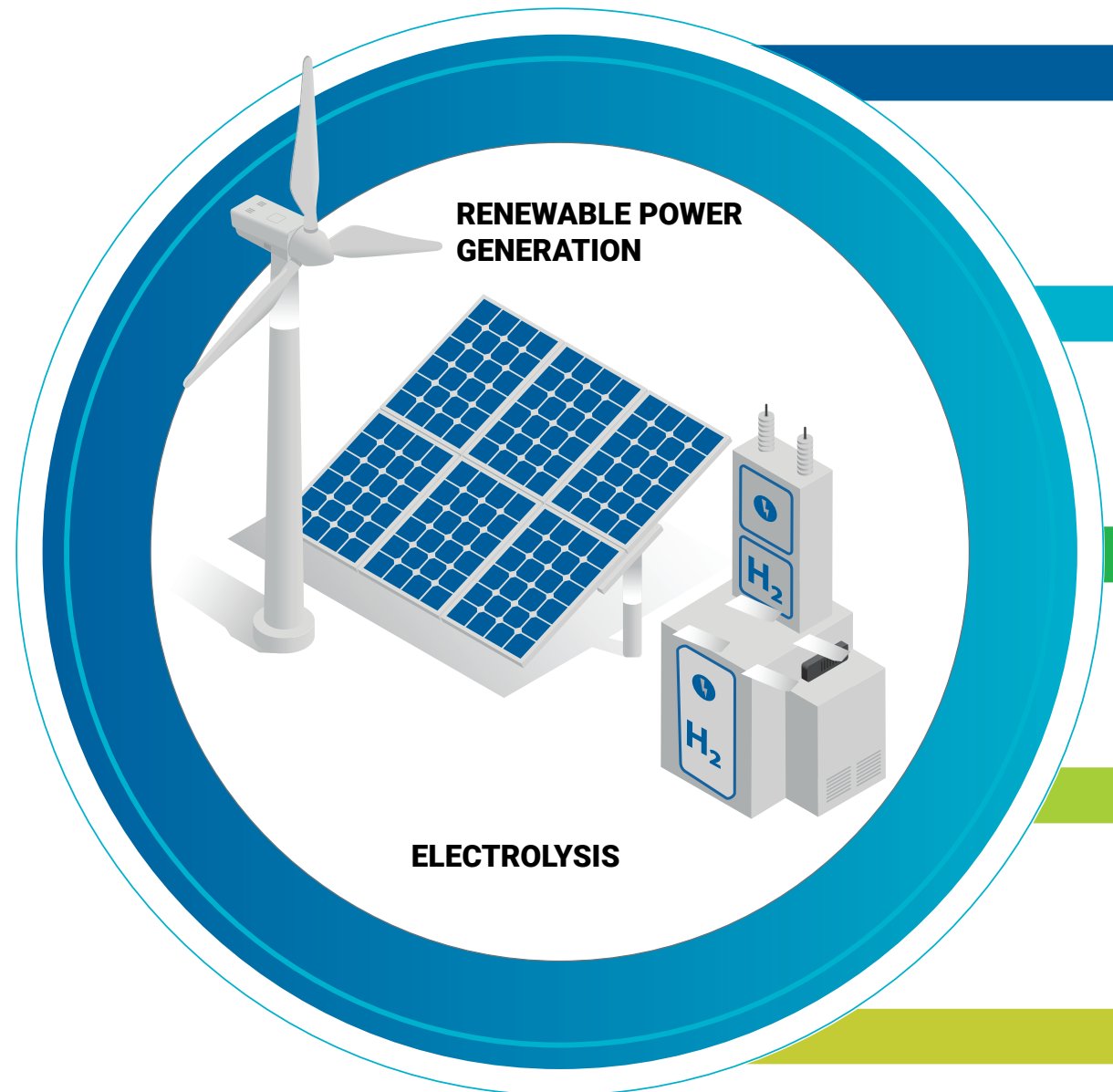
Producing hydrogen from renewable energy sources is the key to decarbonizing the energy industry. The hydrogen obtained is used as fuel for highly efficient, environmentally friendly energy production processes.

We are already developing pioneering technologies for the production of hydrogen to meet the rapidly growing demand for sustainably produced hydrogen - in the chemical industry, heavy industry, or in the area of mobility. As an engineering service provider, we offer you the opportunity to develop a system tailored to your requirements thanks to our innovative concepts.

FROM FIRST CONCEPT TO INDUSTRIALIZATION

Whatever application you are pursuing to obtain sustainably produced hydrogen: With our intensive activities within the scope of our own research and development, as well as our experience from numerous customer projects, we address the complexity of the topic. This enables us to respond to your specific needs with precision. Which benefits you.

With our comprehensive knowledge, we are there for you throughout the entire technology process.





Transport

Carbon Neutral
Mobility

Power Storage



Renewable
Power



Power

System Resilience and
Contribution to Lower Carbon
Heat and Power



Production of
Chemicals, Steel, Iron

Industry

Feedback
for Industry



Feedstock for Hydrocarbon Fuels
and Basis for Synthetic Fuels

Refining

Hydrocarbon Fuels



On-Site Power
and Heating

Buildings

Decentralised Lower Carbon
Heat and Power

Electrolysis Systems Engineering

Hydrogen can make a significant contribution to climate protection. With highly efficient electrolysis technology, we accompany you on your way to a more sustainable future.


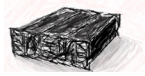
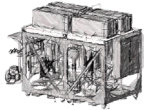
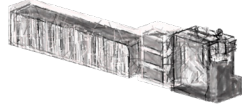
Our goal is to support the hydrogen industry in speeding up. We help our customers in bringing efficient, robust and affordable electrolysis technologies on the market within a reasonable cost and timeframe.

We are a technology provider with significant IP in electrolysis technologies. Hence, we deliver high-end customer-specific engineering, testing and software solutions for a variety of electrolysis technologies (see table on the right).

We are your perfect partner if you:

- are searching for the technology that fits perfectly for your application
- want to get relevant and reliable information regarding market developments
- are interested in future component requirements and challenges
- need to develop of your own electrolysis stack, system or application
- need support building and testing your first demonstrators

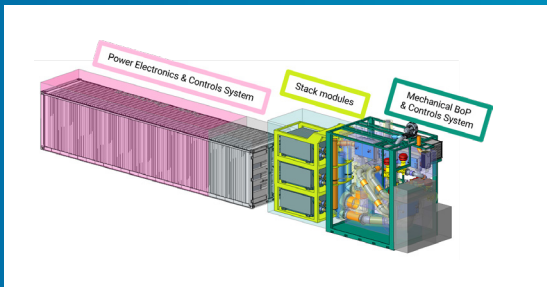
AVL ELECTROLYSIS TECHNOLOGY OFFERING AND SERVICES

	SOEC	PEM	AEM	AEL
Cell 		●	●	
Stack 		●	●	●
System 	●	●	●	●
Application 	●	●	●	●

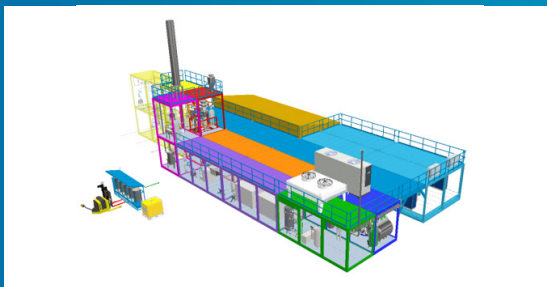
PEM and SOEC Reference Projects



Next Generation Electrolyzer Technologies: 1 MW 40 ft Container Solid Oxide Electrolysis System



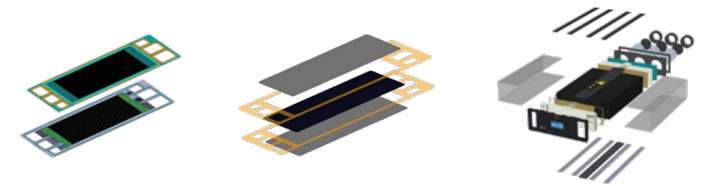
Power-to-H₂ Development: 1 MW SOEC platform ready for technology



SOEC Power-to-Liquid Demonstration Plant

CUSTOM-ENGINEERED PEM & AEM ELECTROLYZER STACK DESIGNS

- Design of bipolar plates
- Design of membrane electrode assemblies
- Design of stack hardware



ELECTROLYSIS TESTING INFRASTRUCTURE

- Power range: 1 kW – 6 MW
- Test centers: Vancouver/CAN, Graz/AUT, Remscheid/GER
- Application: Single cell, stack, system, application
- Technology: AEL, AEM, PEM, SOEC,...

Electrolyzer Testing Solutions

AVL's electrolyzer testing solutions: essential for optimizing performance and efficiency in hydrogen production.

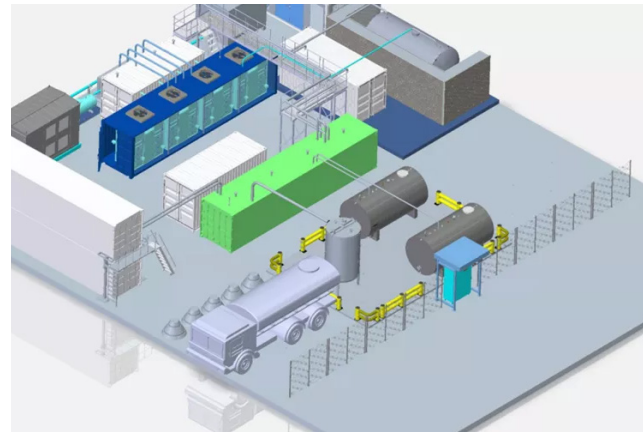
FROM RESEARCH AND DEVELOPMENT

Together with our partner Greenlight we are able to supply test stands for hydrogen electrolyser research, with platforms up to 4MW. We have been manufacturing electrolyser testing equipment since 1996, and can provide references from major companies and research institutes worldwide.



TO SYSTEM INTEGRATION AND VALIDATION

Electrolyzer integration and system testing are crucial stages in ensuring the seamless operation of hydrogen production systems. AVL's modular testing solutions paired with AVL's testing protocols allow the verification of component compatibility, assess performance under various conditions, and fine-tune parameters for optimal efficiency, reliability, and safety.



Complete electrolyzer system test infrastructure for monitoring, testing and optimization.





FROM THE FIRST IDEA TO REALIZATION

AVL has a unique advantage due to our global engineering centers and diverse customer base. This provides us with a comprehensive understanding of future market developments. Combined with the fact that we build and operate our own tech centers makes us perfectly suited to offer this expertise to our customers through consulting projects.



TESTING SOLUTIONS FOR EVERY DEVELOPMENT STEP

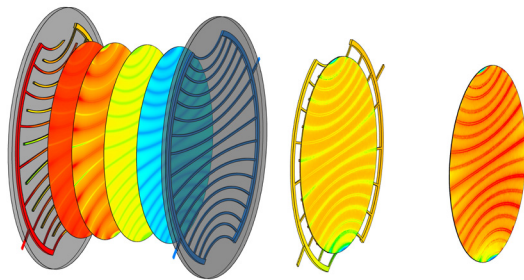
- Cell & Stack test beds
- Tailored System Testing solutions
- Degradation Monitoring toolchain
- Plant Monitoring software
- Facility Engineering & Consulting
- Maintenance Services
- In-use and maintenance services

Electrolyzer Simulation Solutions

AVL's scalable electrolyzer simulation solutions: supporting system design, component development and operating strategy definition.

FROM CELL TO STACK

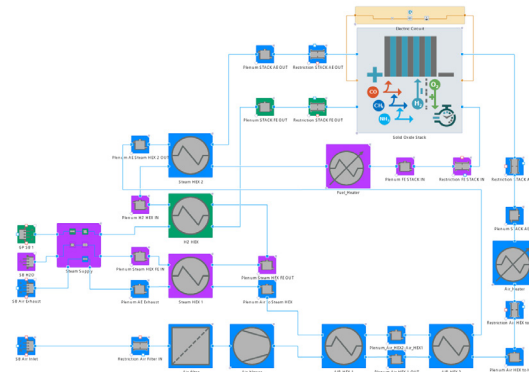
Our 3D multi-physics simulation solution AVL FIRE™ M enables detailed insights into cell and stack internal transport and electrochemical species conversion processes governing performance and lifetime. High-fidelity physics-based models ensure highly accurate results serving as sound basis for dependable design and sub-component related decisions.



Simulated cell internal quantities (membrane current density, water content and temperature) in a Proton Exchange Membrane electrolyzer.

FROM CONCEPT DESIGN TO CALIBRATION

AVL CRUISE™ M, our versatile multi-domain system simulation platform, supports virtual electrolyzer system engineering in all phases of the development process. Its inherent realtime capabilities ensure seamless use of complex multi-physical system plant models in various SiL and HiL applications.



Schematic view of a Solid Oxide Electrolyzer System for H2 production

Scalable component to system simulation solutions for major electrolyzer technologies.





SPEED UP YOUR DEVELOPMENT

By adopting AVL's advanced simulation solutions, you can successfully master electrolyzer system complexity related challenges. System simulations support you in e.g. concept design decisions, balance-of-plant components selection and sizing as well as control function development and thus help you to reduce development time and costs.



SIMULATION SOLUTIONS FOR MAJOR DEVELOPMENT CHALLENGES

- Cell & stack performance and lifetime optimization
- System architecture layout and component requirements specification
- Media supply and thermal management sub-system configuration
- Component technology selection and sizing
- Virtual system integration and operating strategy definition
- Simulation aided control function development and calibration

Innovation for a Sustainable Hydrogen Production From One Source

Simulation

TOOLS & METHODOLOGY SUPPORTING THE ENTIRE DEVELOPMENT PROCESS

Engineering

DRIVING INNOVATION FROM STACK TO SYSTEM FOR ELECTROLYZER SOLUTIONS

Test Solutions

TESTING EQUIPMENT AND SOLUTIONS ENABLING STATE OF THE ART COMPONENT AND PRODUCT VALIDATION

Facility Services

DRIVING INNOVATION FROM STACK TO SYSTEM FOR ELECTROLYZER SOLUTIONS

Global Presence

MORE THAN 90 LOCATIONS WITH 45 TECH AND ENGINEERING CENTERS

One Partner

WE OFFER INNOVATIVE THINKING, AND EFFECTIVE PROJECT MANAGEMENT TO SUPPORT PROFESSIONAL SOLUTIONS.





As one of the world's leading technology companies for engineering, simulation, and testing, we constantly transform our portfolio of high-end methodologies and technologies to support our customers in achieving their ambitions.

We are driving innovation today, to build the industrial energy concepts of tomorrow.

With future-proven tools, products and systems augmented by our global network of experts and facilities, we support our customers to shape current and future technologies for all applications.



We owe it to the planet

For a greener, safer, better world of mobility.

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