

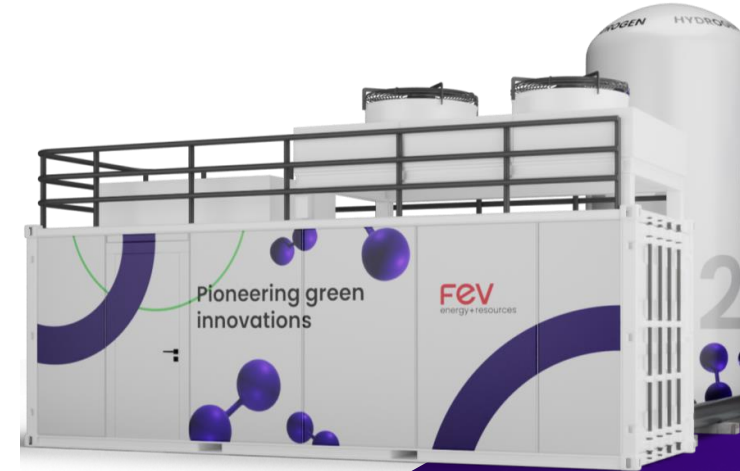
Intelligent electrolyzer control & operation management software

FEV SIGNATURE SOLUTIONS

Improve efficiency, extend stack life, and accelerate the development of your electrolyzer system

FEV offers

- Real-time capable programmable logic controller (PLC) based, technology-agnostic (PEM, AEM, SOEC) electrolyzer system control and safety software
- Optimization of operating strategy to increase efficiency and reduce stack aging backed up by our electrolyzer aging prediction tools
- Modular software architecture for stack, power electronics, and balance of plant (BoP) components
- Grid integration and dynamic adjustment of load based on renewable energy availability
- White box option enabling you to use our software for your own development
- Additional services as PLC configuration, modification/extension, integration, commissioning and calibration



Why FEV

- 45+ years of automotive engineering excellence, trusted by global OEMs and Tier-X suppliers
- 20+ years of know-how in fuel cell systems and extensive control systems applied to electrolyzer controls
- Complete lifecycle support, from concept to series maturity, including design, simulation, prototyping, testing, industrialization, and implementation
- Customer-centric and customizable solutions (P&ID configuration, EL type), enabling you to develop, integrate, and scale your own system

Reference projects FEV energy + resources

Control strategy development

FEV involvement

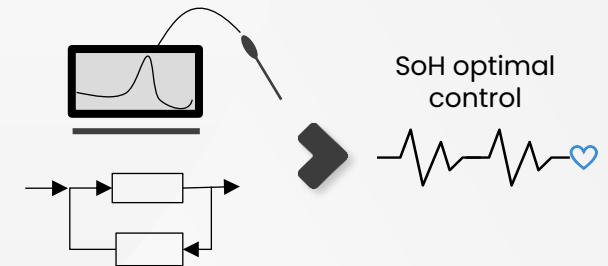
Testing, EIS and SoH optimal controls development for an AEM electrolyzer

- Testing and benchmarking of an anion exchange membrane (AEM) electrolyzer system
- Electro-impedance spectroscopy (EIS) investigation & sensitivity study for degradation impact rating
- Controls software implementation incl. State of Health (SOH) diagnostics for lifetime optimization
- System scaling and degradation simulation for 1MW system

Development of a SOEC electrolyzer system

- Development and design of a complete solid oxide electrolysis (SOEC) system
- Development of control strategy and safety functions
- Cabinet planning and build
- Build-up and configuration of E/E system hardware
- Controls software implementation
- Commissioning of full system & CE certification

Condition monitoring with control strategies



Control of SOEC system with industrial grade Beckhoff PLC



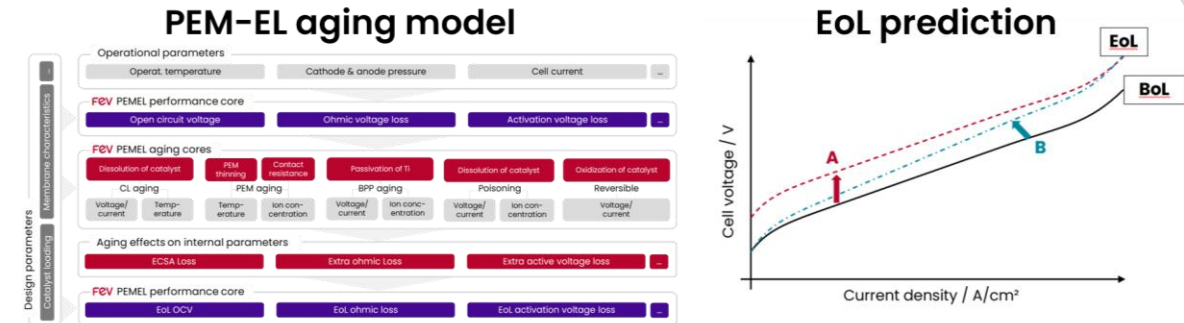
Reference project FEV energy + resources

Customization of FEV's electrolyzer aging model for PEM electrolyzer of Asian OEM

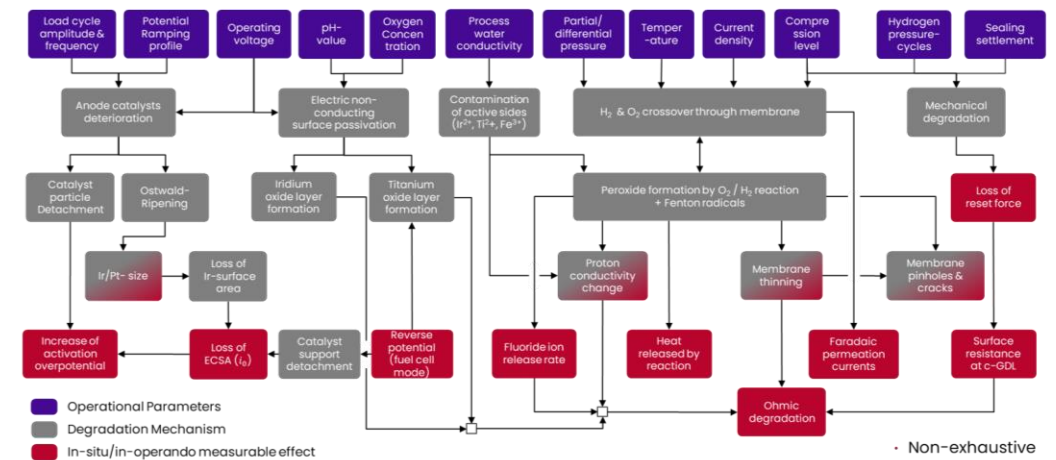
Background: Development of a proton exchange membrane (PEM) electrolyzer degradation catalog, model development and model-based quantification of degradation in a PEM electrolyzer application.

FEV involvement

- Physical-empirical electrolysis degradation model
 - Determination of mathematical descriptions for degradation mechanism
 - Calibration of degradation mechanism according to measurement data
 - Assessment of the performance over lifetime
- Implementation of the developed degradation model into an existing simulation framework
- Load cycle preparation & lifetime prediction simulation



Modeling single degradation stressors and mechanisms



Model for determining the degradation of a polymer membrane electrolysis cell

KEXEL ET AL., DE10202115470A1 (application)



Selected features of FEV's intelligent electrolyzer control unit

Power manager

Coordination and control of the current demand based on H₂ production rate considering system limitations.

State machine

Determination of the electrolyzer state i.e. start-up, shut-down process with wide-range of diagnostics to ensure reliable operation.

Diagnostics management

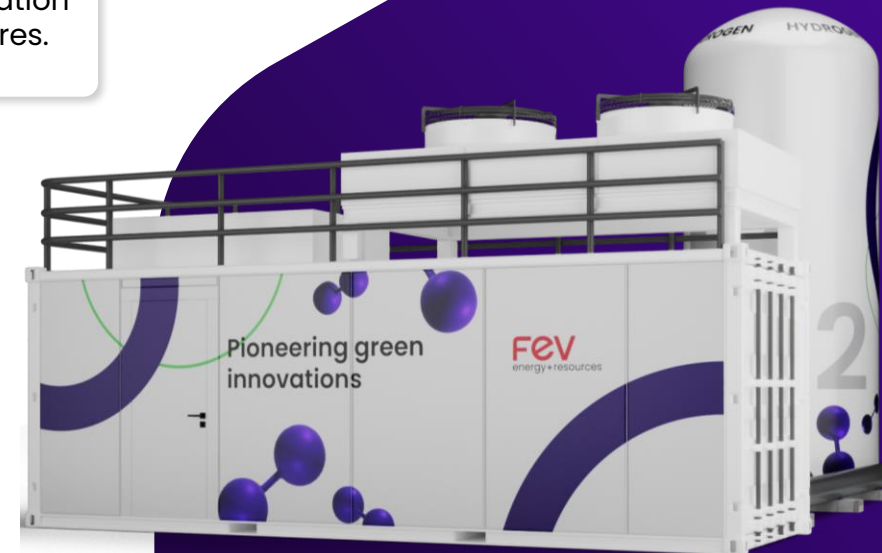
Continuous monitoring of the system to ensure maximum system utilization and safety by switching to safe operation mode in case of failures.

Thermal management

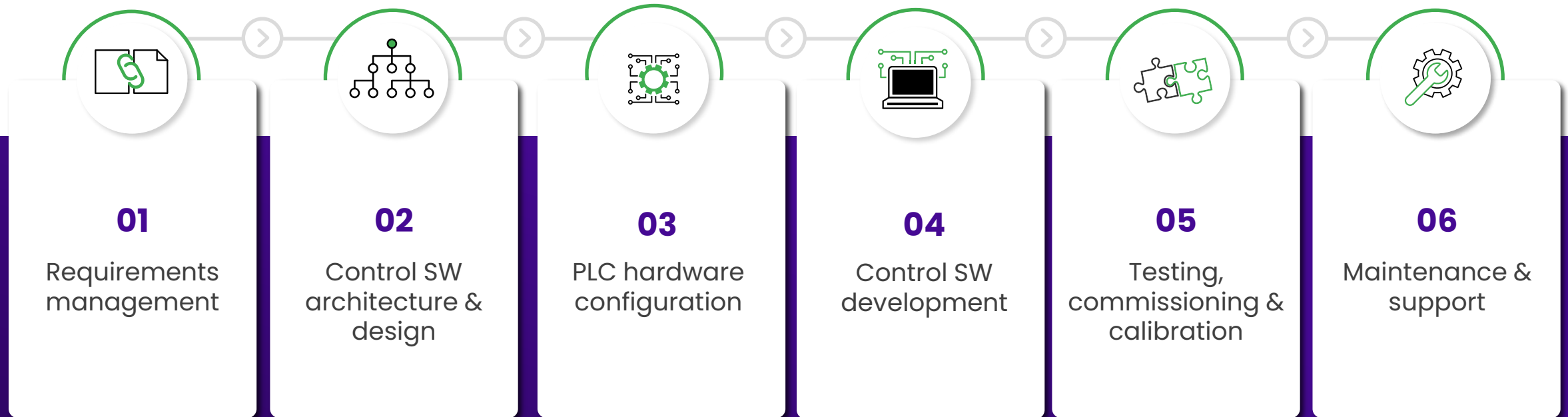
Temperature control of the stack and BoP components for efficiency, minimal degradation and reliable operation.

Anode & cathode-side process path & feedwater control

Control of feedwater flow and pressure along with hydrogen & oxygen side pressure management, hydrogen separation, gas-liquid separation and drying process, for improved efficiency.



FEV provides turnkey solutions and complete development support for electrolyzer control systems across their full lifecycle



Get in touch with us for further information



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