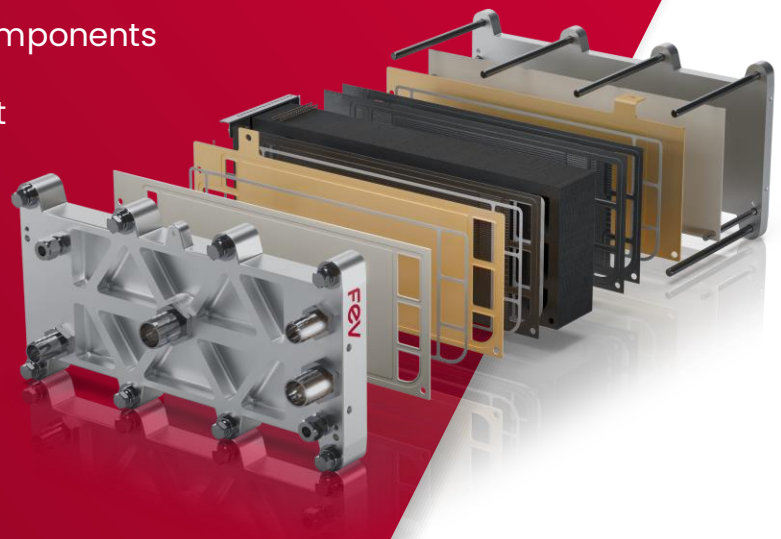
FEV Signature Solutions

FEV fuel cell stack development

Complete development process of fuel cell stacks according to your specifications

FEV offers

- Clean sheet development of fuel cell stacks including design of bipolar plates and compression system
- Validated CAE tool chain for efficient and cost-effective development process
- Thorough selection and layout of components
- Supplier selection and management up to start of production



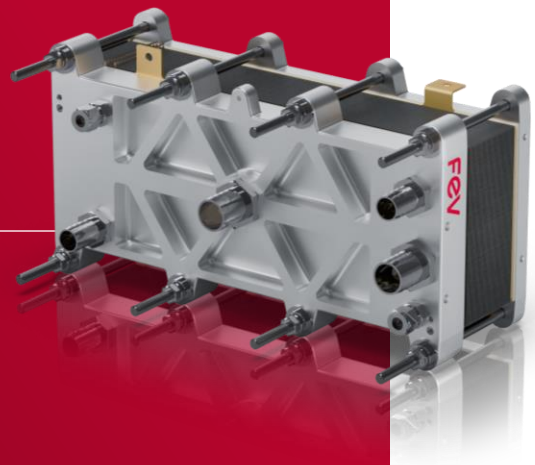
Why FEV

- Proven development process applied to various vehicle applications and continuously optimized during the last 5 years (see reference slide)
- Long term experience in fuel cell design due to benchmarking activities and market observation
- White box option to enable customer to use FEV's development process as basis for its own development
- Customization by FEV to exactly address customers' needs

Reference Projects
Fuel Cell Development

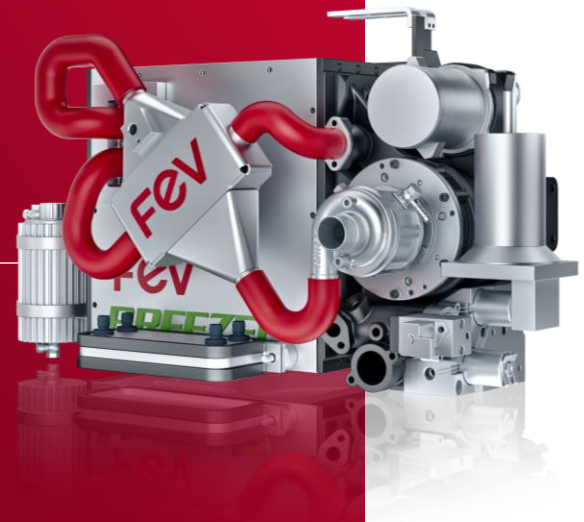
FEV propulsion

BIFOILSTACK*



Innovation	Task	Realization
Usage of graphite-plastic composite material for bipolar plates to combine advantages of graphite and metallic bipolar plates	Development of all relevant fuel cell stack components in consultation with project partners and suppliers. Development and testing of a fuel cell short stack with 40 cells	Prototype components in procurement and experimental validation planned for 2025

BREEZE



Usage of hydroformed stainless steel for bipolar plates to realize compact stack designs. End plates as a highly integrated aggregate carrier.	Development of all relevant fuel cell stack components in consultation with project partners and suppliers. Development, build-up and testing of a 30-kW net fuel cell system with 150 cells	Fuel cell system integrated and running in a Fiat 500 since Q4/2015

*Funding provided by BMWK under number 03EN5018A

BREEZE - Low-temperature fuel cell with integrated system functions

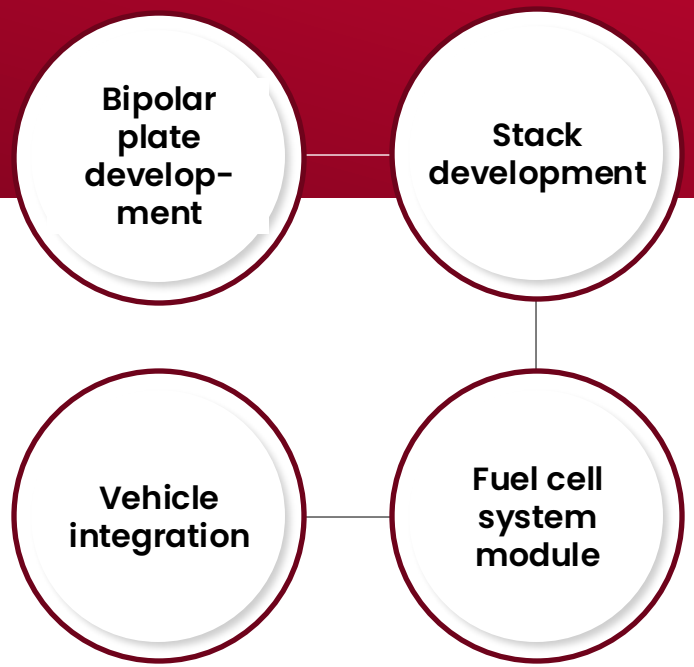
FUEL CELL PLUG-IN HYBRID WITH 30 KW NET FUEL CELL SYSTEM

Technical features

- Low temperature PEM fuel cell with 30 kW electric power
- All electric range approx. 300 km
- Identical package as internal combustion engine range extender
  - Metallic bipolar plates → Cell pitch <1.2 mm
  - Integration of Balance-of-Plant components
  - Dry cathode/passive humidification at anode

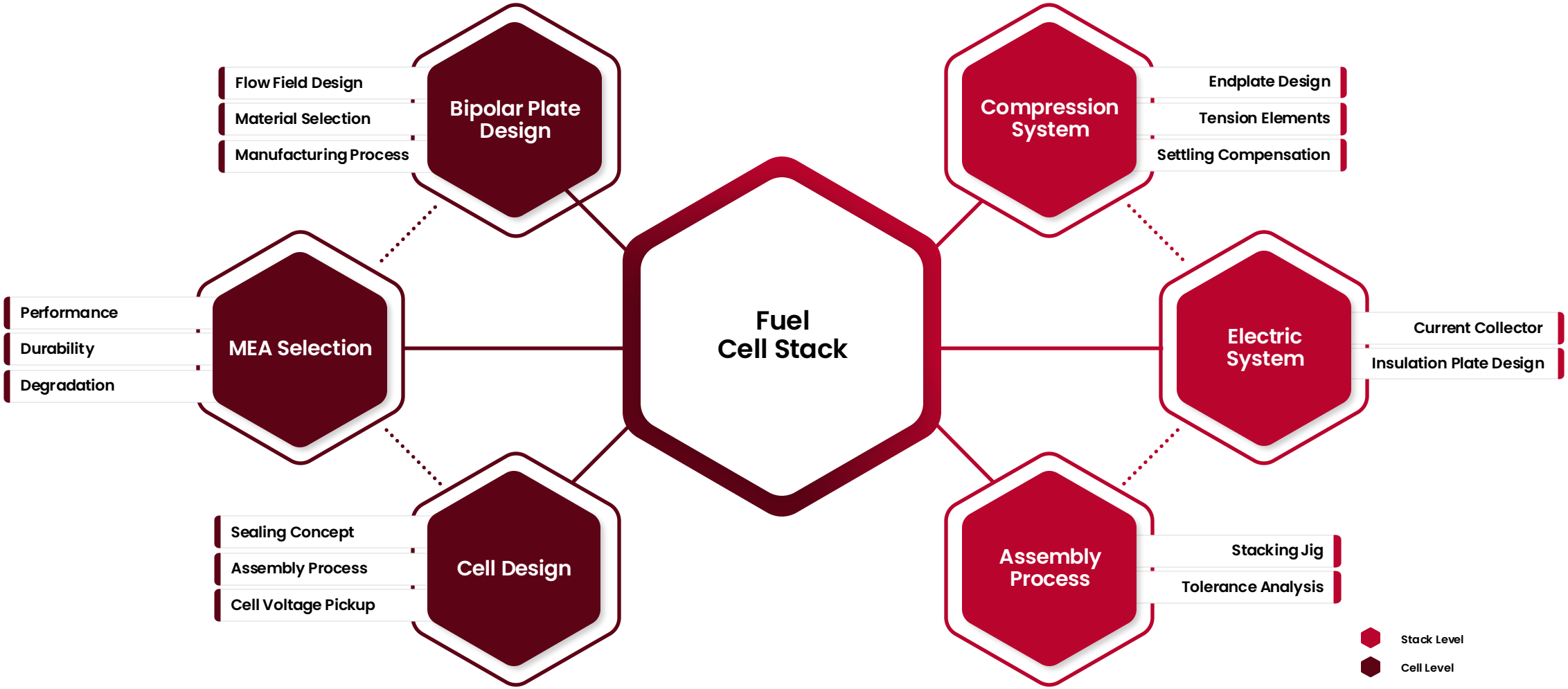
FEV involvement

- Turn-key project for fuel cell propulsion based on Smartwheels BEV
- Fuel cell system development including build-up
  - Stack development, design and build
  - Fuel cell system development, design and build
  - Fuel cell system APSW including functional safety concept
- Vehicle integration
  - Hydrogen storage
  - Thermal system
  - E/E and supervisory propulsion controls
- Homologation for use on public roads



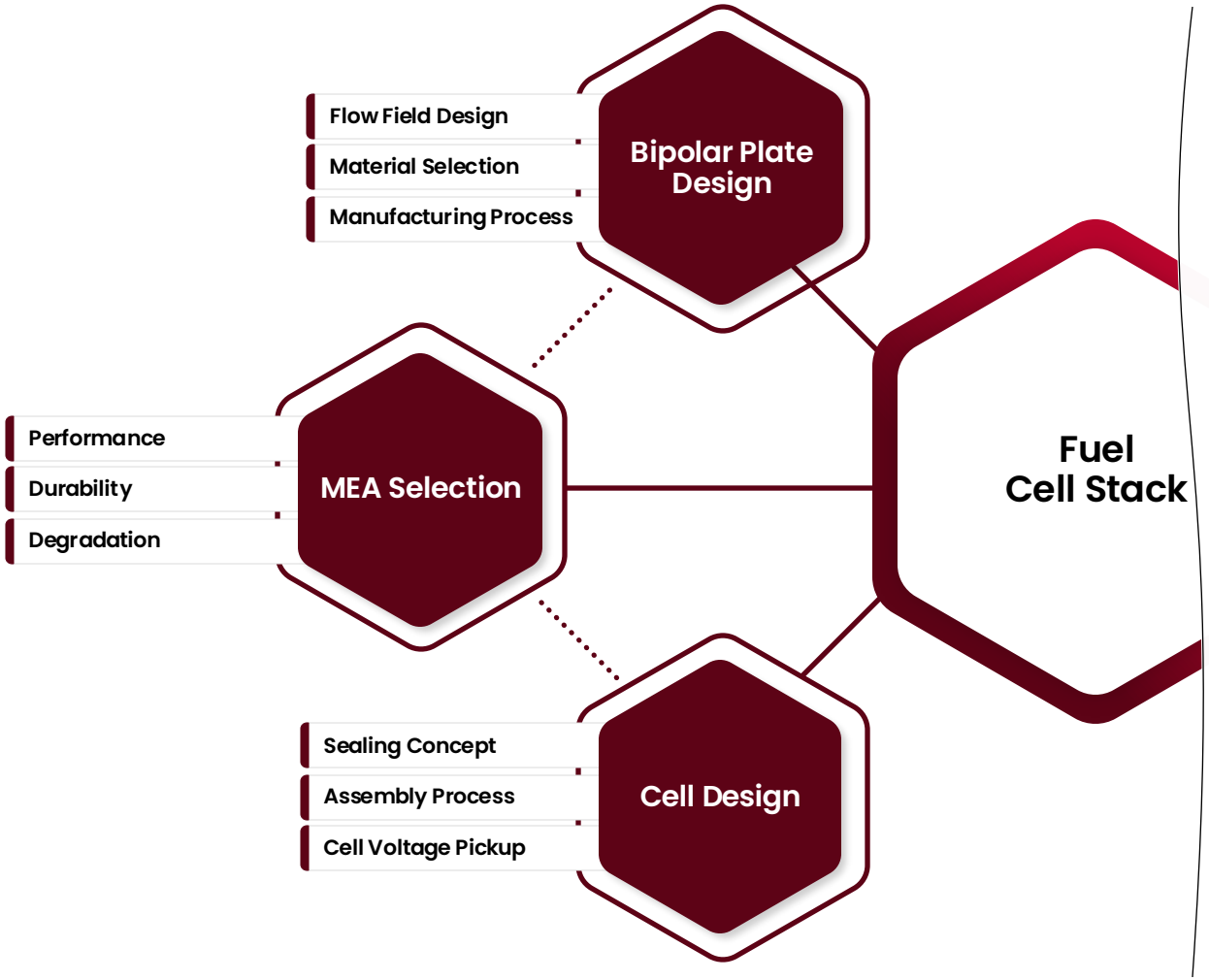
Fuel Cell Stack Development – Comprehensive Overview of Development Activities

SELECTED HIGHLIGHTS

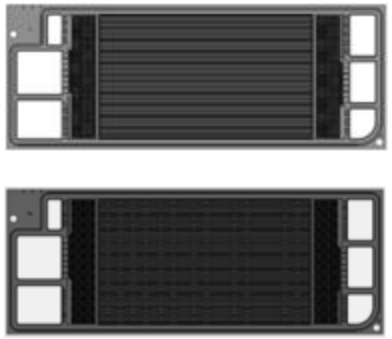


Fuel Cell Stack Development – Efficient Cell Design with strong CAE Frontloading

SELECTED HIGHLIGHTS

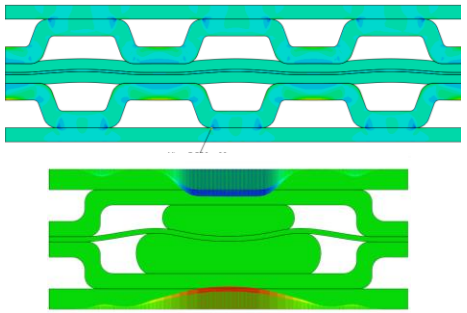


Bipolar plate-CAD

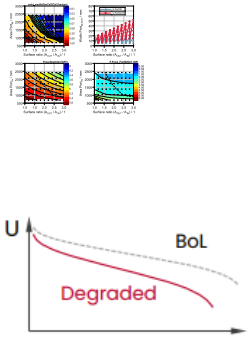


3D-CFD of flow field

FE Simulation of complete fuel cell



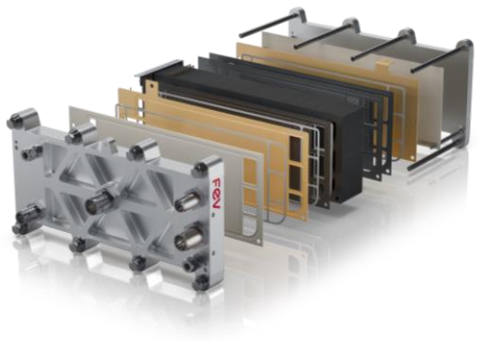
1D/0D Simulation



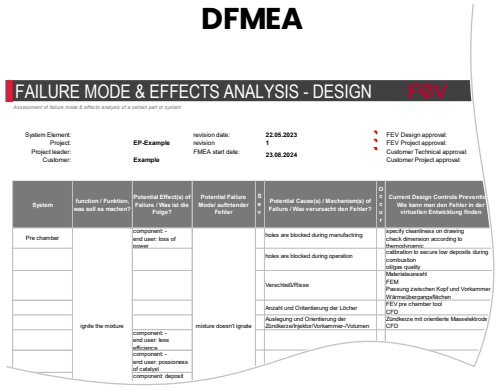
Fuel Cell Stack Development – Compression System Design and Layout of Electric System

SELECTED HIGHLIGHTS

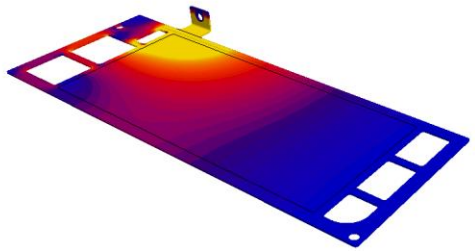
CAD



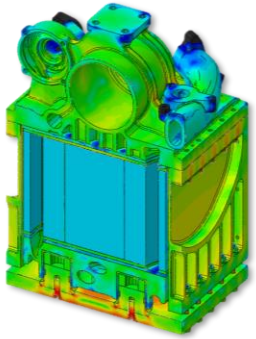
DFMEA

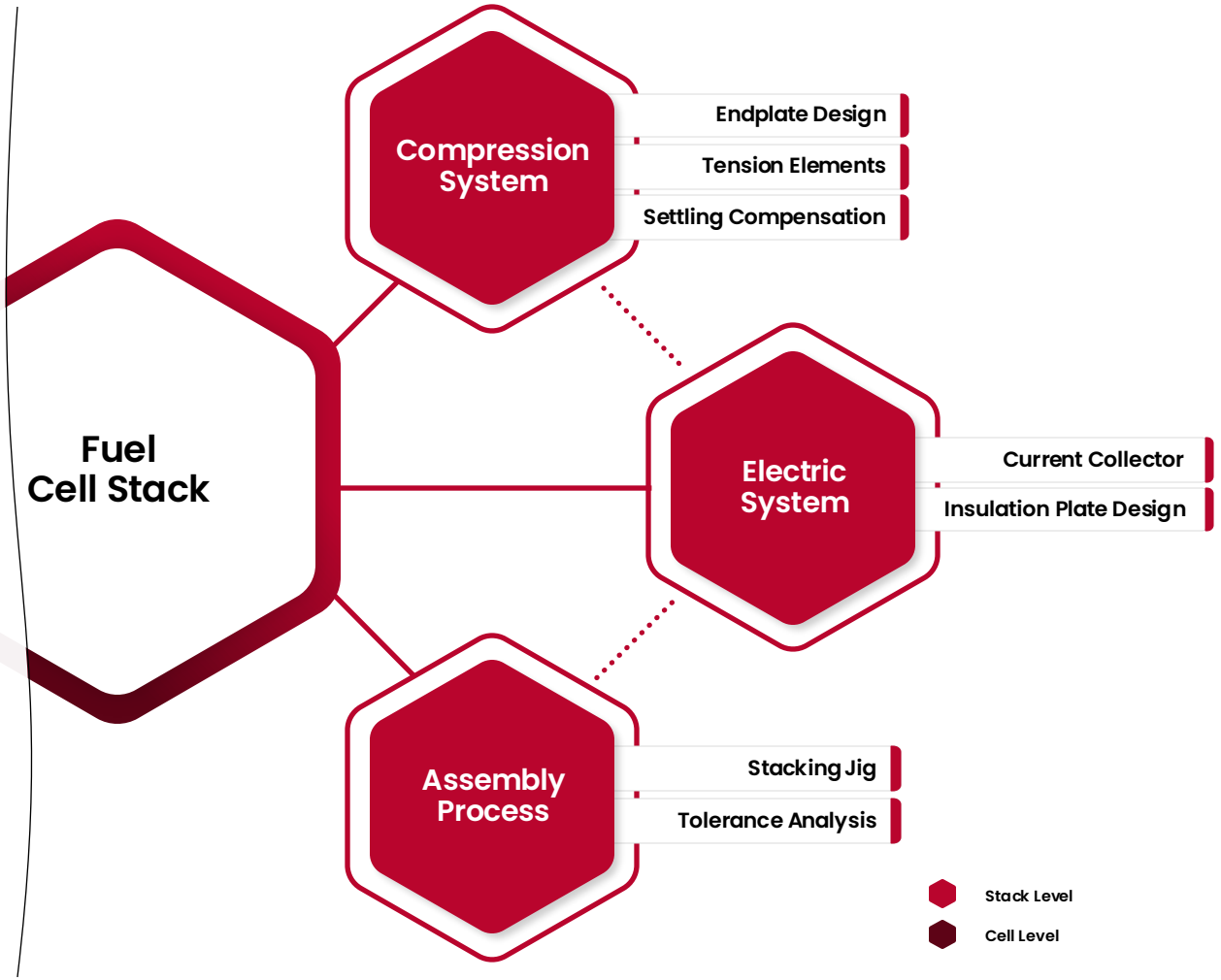


Electric Calculation



Thermal FEA





All in one hand – validation of fuel cell performance on FEV test benches

THOROUGH TESTING OF DEVELOPED FUEL CELL STACK OR SYSTEM

Design validation plan

FEV database on international legislations

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Pre-defined tests and test blocks

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Compilation of test blocks according to customer's needs

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Customized design validation plan

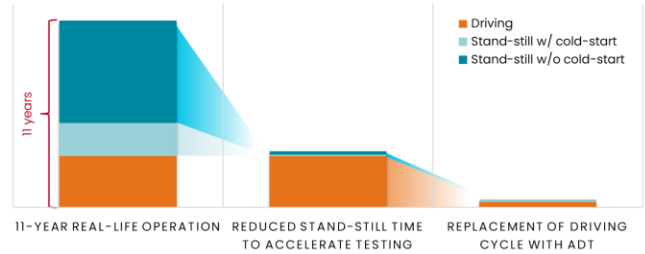
Testing

Cell testing

Stack testing

Methods (Examples)

- Performance Testing
- Accelerated Ageing Tests (incl. Cold Start Tests)
  - Comprehensive assessment of load cycles and stand-still periods
  - Identify stressors and parts of the cycle with low degradation
  - Realistic aging behavior despite accelerating by a factor > 6 beyond "quick wins"



Get in touch with us for further information

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