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IFA
Institute of Powertrain
& Automotive Technology

Austro Engine

Dual Fuel H_2 Engine

Hydrogen-Kerosene Dual-Fuel Engine to Reduce Pollutant and CO_2 Emissions in General Aviation

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Brief description of the consortium partners

- **IFA**: Project lead, development of combustion process for hydrogen-kerosine dual fuel operation (experimental + simulation), LCA, scientific dissemination of results
- **Austro Engine GmbH**: Supply of the aircraft piston engine, support in evaluating measurement results

Supporting partners:

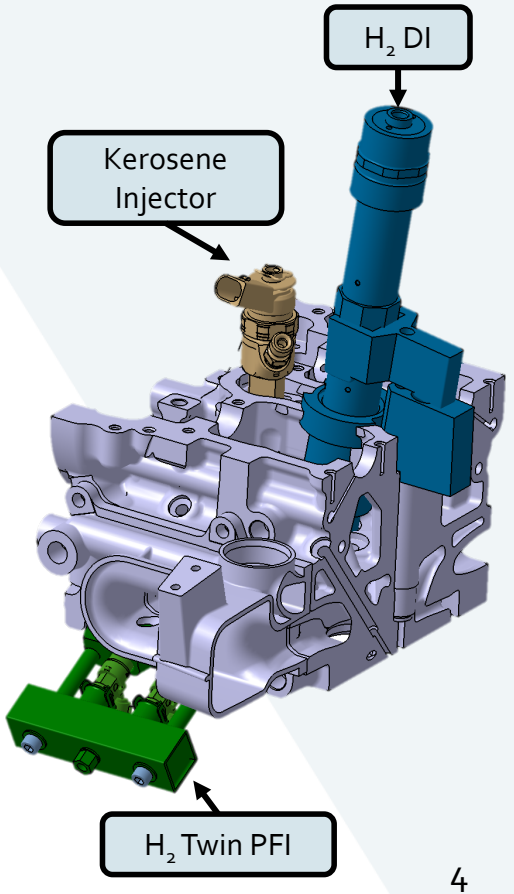
- **Bosch General Aviation Technology GmbH**: Supply of the hydrogen PFI injectors
- **Schaeffler AG**: Supply of the hydrogen DI injector and periphery, support in evaluating measurement results
- **BP p.l.c.:** Supply of the engine lubricants

Aim of the project / Background of the project

- **Background**: Aviation demand is expected to grow rapidly → reduction of CO_2-emissions in aviation necessary via alternative propulsion systems
- **Aim of the project**: Development of a dual-fuel (hydrogen and kerosene) capable combustion engine for use in small aircraft
  - Drastically reduce pollutant- and CO_2-emissions
  - Maintain similar performance as the base engine
  - Fuel switch during operation to meet all safety requirements

Methodology

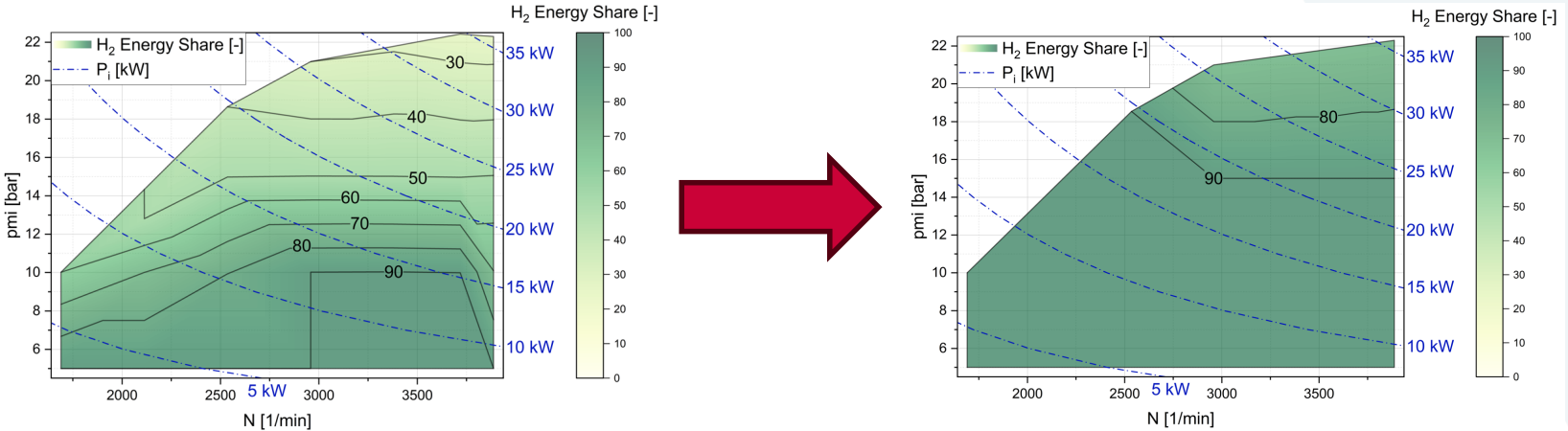
- Abnormal combustion, e.g., **pre-ignitions**, as a major limitation and challenge in hydrogen internal combustion engines → Strategies to **mitigate pre-ignitions** were developed, including
  - Exhaust gas recirculation (EGR)
  - Water injection
  - Compression ratio reduction
  - Ultra lean operation
  - Hydrogen direct injection (DI)



Project results

- **Using the strategies and optimized operation, >90% H2 energy share** in most of the engine map using the identified strategies was achieved with equivalent CO2 reduction

- At full load up to **70% H2 energy share** with equivalent CO2 reduction was achieved, while
  - **efficiency** was **increased** by **3 pt%.** and
  - **peak pressure** was **reduced** by **10%** compared to base kerosene operation



Utilization of the project

- 5 Peer-reviewed paper
- 3 Presentations at scientific conferences
- 1 PhD thesis
- 1 Project thesis
- 4 Bachelor theses
- 3 Diploma theses

Further steps/(potential) follow-up projects

- With the project successfully concluded, the project partner and engine manufacturer (Austro Engine) is taking the next steps internally to operate the hydrogen engine in an aircraft application
- Projects involving the use of hydrogen will be pursued further