

**LEC GETS
LEC Green Energy and
Transportation Systems**

Program: COMET – Competence
Centers for Excellent Technologies

Program line: COMET-Center (K1)

Project type: strategic
Project duration: 2023+



LEC EXPANDS ITS PIONEERING POSITION IN AMMONIA RESEARCH

THANKS TO THE NEW INFRASTRUCTURE FOR OPERATING THE TEST BENCHES WITH AMMONIA, THE LEC HAS MADE SIGNIFICANT PROGRESS IN THE EFFICIENT USE OF THIS HIGHLY RELEVANT FUTURE FUEL IN LARGE ENGINES.

The storage of green hydrogen in the form of ammonia will be of crucial for the energy transition. The significantly better storage conditions compared to pure hydrogen are ideal for using ammonia for seasonal energy storage as well as for the efficient transportation of energy over long distances. For further use, ammonia can be converted back into hydrogen or used directly while avoiding conversion losses. Especially when transporting ammonia by ship, which will play an important role in the future due to the rapidly increasing demand for energy transportation from regions with high surpluses of renewable energy sources, the direct use of ammonia to generate the necessary propulsion energy is extremely beneficial for both ecological and economic reasons.

New benchmarks for the use of ammonia in large engines for the energy and transportation sector

The LEC at the Graz University of Technology aims to set new benchmarks in the field of the use of ammonia in the energy and transport sector. After about 2 years of preparation, during which the main focus was on the development of safety concepts and the implementation of emission-avoiding measures for the operation of the test benches with ammonia, the LEC was the first research institution worldwide to start experimental investigations into the development of suitable engine concepts for large engine applications in spring 2022.

SUCCESS STORY

In the course of almost two years of research and development work, significant progress was made in both spark-ignited combustion processes (power generation) and compression-ignited combustion processes (marine and locomotive applications, etc.).

Despite the unfavorable combustion properties of ammonia, the developed processes allow efficiencies above those of conventional engine concepts. The parameters of the exhaust gas obtained with the optimized concepts also form the basis for deriving efficient exhaust gas aftertreatment systems. Provided that green ammonia is used, the processes can be regarded as practically climate-neutral. The successful activities also served as the basis for the integration of the LEC into international ammonia research projects, such as the Campfire project or the EU project APOLO.

The following main results were achieved:

- Proven concept for the reliable operation of engine test benches with ammonia
- Development and comprehensive evaluation of various combustion concepts for ammonia as a basis for practical implementation (in cooperation with INNIO Jenbacher, the first start-up of an ammonia engine is planned for 2025)
- Creation of a knowledge base to deepen the understanding of the specific processes involved in the combustion of ammonia (influence of turbulence, etc.)
- Overall system analyses based on energetic considerations
- Presentation of findings at international symposia (CIMAC World Congress 2023, Vienna Motor Symposium 2024, etc.)
- Successful application for new research projects and significant expansion of the R&D area with ammonia (Campfire, EU project APOLO, COMET module LEC FFF - Future Fuel Fundamentals, etc.)

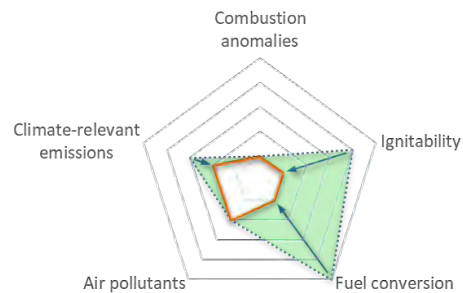


Fig. 1: Improvements in the use of ammonia in large engines / Scaling from excellent (inside) to bad (outside). © LEC GmbH

Project coordination

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