SUCCESS STORY

LEC EvoLET
LEC Evolutionary Large Engines Technology for Sustainable Energy and Transport Systems

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: strategic
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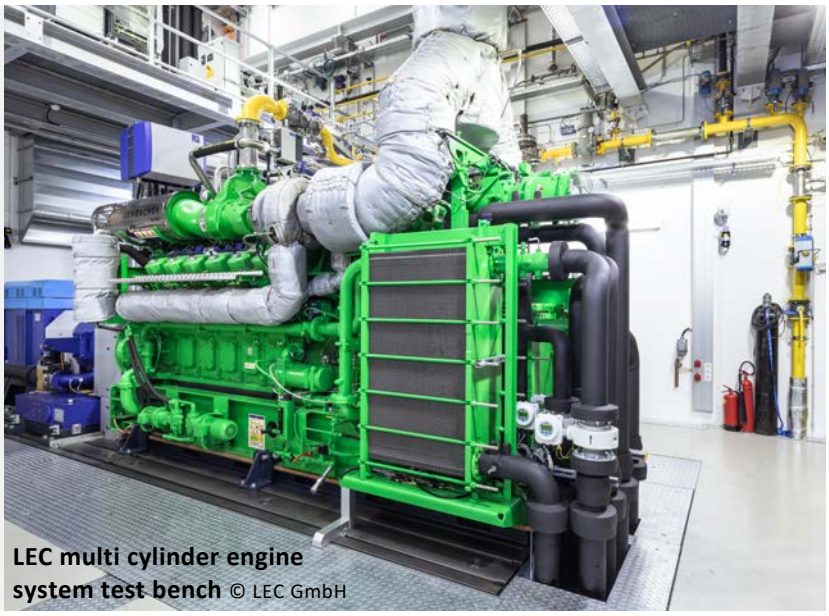

LEC multi cylinder engine system test bench © LEC GmbH

HIGHLY-FLEXIBLE SYSTEM TEST BENCH

IN ORDER TO BE ABLE TO TEST AND DEMONSTRATE FUTURE LOW-EMISSION ENERGY SYSTEMS AND PROPULSION SYSTEMS IN THEIR ENTIRETY, A SYSTEM TEST BENCH BASED ON A FUEL-FLEXIBLE 2 MW MULTI CYLINDER ENGINE WAS SET UP AT THE LEC

The challenge

The quest for sustainable, low-emission and CO_2-free energy and propulsion systems is producing a variety of concepts, the functionalities of which must be tested and demonstrated under realistic conditions before they can be used in the field. Future internal combustion engine applications will use a wide variety of fuels (e.g., hydrogen, natural gas, ammonia, methanol) for which, on the one hand, different combustion processes and, on the other hand, different sub-systems as for example fuel pre-treatment systems and exhaust gas aftertreatment systems are required. The resulting overall systems are complex and sometimes differ greatly from one another. The creation of a test environment that can be flexibly adapted to different system topologies and that also enables the testing of extensive stationary and dynamic operating scenarios is therefore correspondingly challenging.

The innovation

The LEC has established a highly modern test bench, which offers the possibility to test, optimize and demonstrate different energy and propulsion systems based on internal combustion engines, see Figure 1. The core of the test bench is a 2 MW 12-cylinder natural gas engine, which has been upgraded in such a way that it can also be used flexibly for operation with diesel and hydrogen. The overall test bench environment offers the possibility of implementing the sub-systems required upstream (e.g., fuel pre-treatment systems) and downstream (e.g., exhaust

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aftertreatment systems) of then engine, depending on the system topology, thus enabling the entire system to be investigated.

The implementation

In the development phase of the concept for the system test bench, its flexible usability was a central requirement. Creating the possibility of investigating a wide variety of system topologies and using a wide variety of fuels was challenging, not only because of the need to integrate the test environment into the already existing test bench infrastructure and to ensure all required safety measures. The load unit implemented allows engines with a power of up to 3.5 MW to be operated and to feed a large part of the engine's energy output into the power grid as electrical energy. As the base engine, a 12-cylinder engine from INNIO Jenbacher is used. The basic concept is designed for operation with natural gas. However, engine adaptions and the high availability of components make it possible to investigate a very wide range of other fuels (e.g., diesel, hydrogen), combustion concepts and overall systems. System components for exhaust gas aftertreatment, reformers, carbon capture, hybrid applications and hardware-in-the-loop methods can be implemented as required. A reliable and scalable system was procured for test bench automation. It offers maximum user-friendliness and adaptability to a wide range of test tasks.

The impact

With the new multi cylinder engine system test bench, the LEC development methodology has been expanded by a significant area. The system solutions derived from basic research, simulation- and experimental-based technology development, and system simulations can now be tested and demonstrated in their entirety directly at the LEC. With the possibility of providing proof of function for sustainable energy and propulsion systems in the laboratory under real-world conditions, the LEC is making a decisive contribution to accelerating the use of such systems in series production.

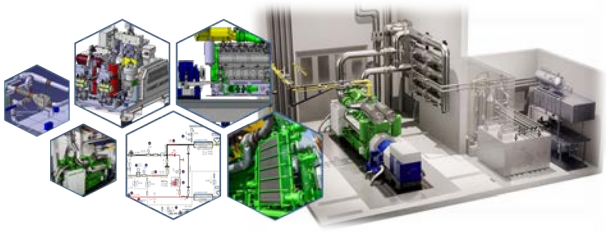

Figure 1: Multi cylinder engine system test bench (© LEC GmbH)

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