

PRESS RELEASE

Research cooperation sets new standards for carbon-neutral and secure energy future

- INNIO and the Graz's LEC (Large Engines Competence Center) have been researching and developing visionary technologies for sustainable energy generation and transport for 25 years
- Hydrogen and hydrogen carrier gases offer promise to resolve electricity storage challenges for the energy transition
- The State of Tyrol is currently providing 2.4 million euros in subsidies to tackle these challenges head on

JENBACH (Austria) - August 23, 2019 - The United Nations Climate Change Agreement and movements such as Fridays for Future are putting pressure on politicians, companies and research institutions to develop sustainable energy solutions. For the past 25 years, INNIO, a pioneer in combined heat and power, and the LEC in Graz have been researching and developing visionary technologies for sustainable power generation and the transport industry. The combustion of so-called e-fuels, i.e. regenerative fuels like hydrogen and hydrogen carrier gases such as synthetic natural gas, methanol or ammonia, is being tested or further optimized. The aims of the research are to develop technologies capable of making drastic carbon dioxide (CO₂) reductions and to build gas engines that are virtually emissions free.

As part of the COMET-K1 research program, the State of Tyrol is providing €2.4 million in funding for technology development including the areas of sustainable power generation and transportation systems. "By subsidizing this research cooperation, we are further advancing our goal of freeing Tyrol from its dependence on fossil fuels by 2050. We are also better positioning ourselves as an attractive business and science location as well as an international partner for

research, development and innovation," said Patrizia Zoller-Frischauf, Tyrolean Minister of Economic Affairs, at a technology forum held today at INNIO's corporate headquarters in Jenbach.

"We are already using regenerative fuels such as hydrogen in our Jenbacher gas engines. In cooperation with the LEC, we are further developing this technology and plan to demonstrate by 2021 that a Jenbacher gas engine can run on up to 100% hydrogen or methanol," underscored Carlos Lange, President & CEO of INNIO. "INNIO will continue to make significant investments in research and development and will further expand its technological leadership in power generation based on regenerative gases. In specific, hydrogen and hydrogen carrier gases produced from surplus energy such as wind or solar power, which are storable for a longer period of time."

Development of emissions-free deep sea shipping

"We are focusing on the development of combustion processes for industrial engines that are as emissions-free, efficient and as fuel-independent as possible," explained Andreas Wimmer, CEO of the LEC, during the technology forum.

A carbon-neutral, 2-megawatt (MW) marine engine will be tested at the LEC in 2020 as part of the EU HyMethShip project. The engine is a Jenbacher Type 6 gas engine that operates on either 100% on hydrogen or 100% on the hydrogen carrier gas methanol, both from renewable energy sources.

"The HyMethShip innovation project, which has already won international awards, sets new standards in the area of emissions-free deep sea shipping and has the potential to eliminate sulfur and CO₂ emissions," says Wimmer.

Further information on the project is available at www.hymethship.com.

Storage presents major challenge for the energy transition

Volatility and the storage of electric power over a longer period of time are a challenge when switching to renewable energies. As a consequence, the LEC is currently researching the combustion of 100% regenerative hydrogen. This fuel is obtained by electrolysis with the aid of excess wind or solar power. Hydrogen can also be converted into hydrogen carrier gases such as synthetic natural gas, ammonia or methanol. It can also be converted back into electricity.

This is where INNIO's Jenbacher gas engines come into play: thanks to their fuel flexibility, they can be operated with gases from renewable sources. As mentioned previously, both INNIO and the LEC have been collaborating for many years on the optimization of these processes. The worldwide delivered INNIO fleet comprises more than 50,000 Jenbacher and Waukesha gas engines. Nearly 55% of those installed in German-speaking countries are already powered by gases from renewable energy sources (mainly biogas, but also hydrogen mixtures). As technological development progresses and the global energy transition takes place, the significance of this area of application will grow exponentially.

Pioneer in the field of digitization

In addition to direct engine technology, INNIO and the LEC are also collaboratively researching new sensor technology as well as data processing, both of which are integral components in terms of sustainability. Today, 60% of all Jenbacher gas engines installed worldwide are monitored online via INNIO's myPlant software. INNIO has thus also become a pioneer in digitalization combined power and heat generation. With its digitization strategy and the new COMET module "LEC HybTec," the LEC is setting new standards when it comes to the fusion of physical and data-driven simulation models. This has led to the development of novel, physically motivated Artificial Intelligence methods and learning methods that are raising the bar in the research and development of sustainable, large gas engines.

About LEC GmbH

The LEC is Austria's leading research institute for large engine technology and ranks among the three best research institutions worldwide. Research focuses on

technology development for sustainable power generation and transportation systems. The COMET KI Center LEC EvoLET, a part of LEC GmbH, creates the foundation for drastic reductions in CO₂ emissions with virtually emissions-free operation. Work centers around optimizing the overall system in addition to the development of large gas engines, the majority of which are designed to run on renewable fuels. Such efforts are designed to enable the best possible use of these engines in a wide range of applications. To this end, the LEC has developed a testing infrastructure system unlike any other in the world featuring single-cylinder research engines at its Graz University of Technology campus. The LEC's partner consortium comprises all technological leaders in the field of innovative engine technology, including many world market leaders. This international partner network, the COMET research program, and a unique infrastructure provide the ideal framework for promoting innovation and developing tailored solutions for industries. The LEC offers interested researchers excellent career prospects. INNIO has collaborated with the LEC since 1994 and has held a 35% stake in LEC GmbH since 2015. Additional stakeholders include the HOERBIGER company as well as the Graz University of Technology and the University of Leoben. The COMET Center is supported by the Austrian Ministry for Transport, Innovation and Technology and the Austrian Federal Ministry of Education, Science and Research as well as by the Federal States of Styria, Tyrol and Vienna.

Event note

Interested parties can obtain further information in person about the work of the LEC by visiting one of two events: The "Grazer Motoren-Symposium (Graz Engines Symposium)" or the "First Sustainable Shipping Technologies Forum" from September 26-27, 2019 in the Graz Congress Center. Further information at www.lec.at. Follow LEC on Twitter and LinkedIn.

About INNIO

INNIO is a leading solutions provider of gas engines, power equipment, a digital platform and related services for power generation and gas compression at or near the point of use. With our Jenbacher and Waukesha product brands, INNIO pushes beyond the possible and looks boldly toward tomorrow. Our diverse portfolio of reliable, economical and sustainable industrial gas engines generates



200 kW to 10 MW of power for numerous industries globally. We can provide life cycle support to the more than 50,000 delivered gas engines worldwide. And, backed by our service network in more than 100 countries, INNIO connects with you locally for rapid response to your service needs.

Headquartered in Jenbach, Austria, the business also has primary operations in Welland, Ontario, Canada, and Waukesha, Wisconsin, US. For more information, visit the company's website at www.innio.com. Follow INNIO on Twitter and LinkedIn.

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