SUCCESS STORY

LEC HybTec
Hybrid Technologies for Enhanced Reliability of Ultra High-performance Engines.

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Module

Type of project: strategic
Short title: LEC HybTec
Duration: 2020-2023

OPTIMIZATION METHODOLOGY FOR CLIMATE NEUTRAL ENERGY SYSTEMS

THE INTEGRATION OF RENEWABLE SOURCES SIGNIFICANTLY INCREASES THE COMPLEXITY OF ENERGY SYSTEMS. THE INNOVATIVE SIMULATION METHODOLOGY LEC ENERSIM ENABLES EFFICIENT OPTIMIZATION TO ACHIEVE CO2 TARGETS.

The integration of renewable energy sources into future energy systems requires flexibility and high interconnection. Challenges include the short-term and seasonal storage of solar and wind energy as well as the smart coupling of all sectors such as power generation, mobility, industry and heat applications. The design and optimization of such systems with a large number of degrees of freedom requires sophisticated simulation tools that generate reliable models of the system components and also take into account the complexity of energy markets. Based on these techno-economic models, energy systems can be optimally designed for the specific application by choosing the most appropriate technologies in terms of system layout and component dimensioning. Ultimately, the aim is to find an optimized operating strategy for the overall system that enables maximum efficiency and the lowest environmental impact at the best cost-effectiveness.

Modular simulation platform LEC ENERsim

The basic methodology for the simulation platform LEC ENERsim was developed in the COMET module LEC HybTec and can be used to optimize various energy systems. The methodology enables the coupling of various energy system components such as energy sources, converters, storages, grids or consumers. The physical properties of the components are represented by models that can also take

Federal Ministry
Republic of Austria
Climate Action, Environment, Energy, Mobility, Innovation and Technology

Federal Ministry
Republic of Austria
Digital and Economic Affairs

Version 01/2020

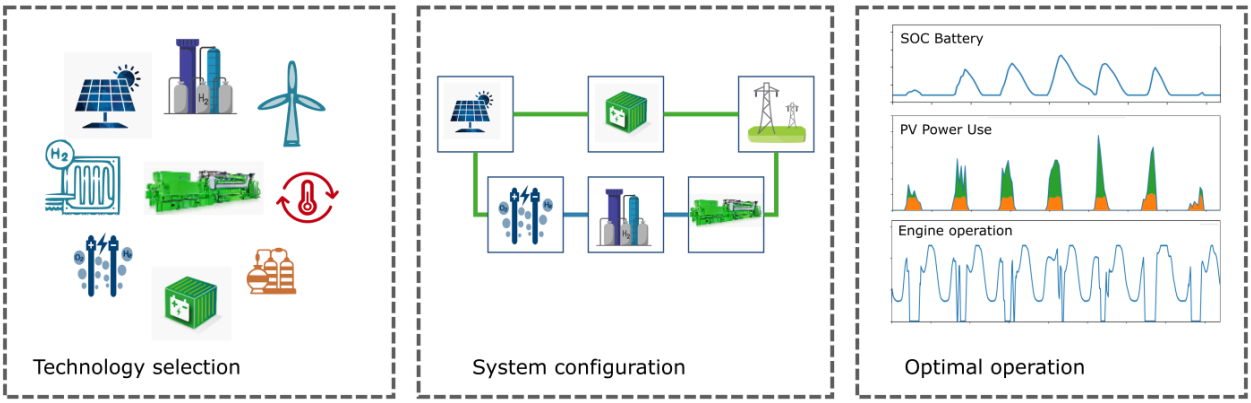
additional economic aspects into account. The modeling of generic energy flows between the system components also enables a complete sector coupling between electricity, heat, chemical energies and mechanical drive. Target applications include decarbonization of power plants, conversion chains for synthetic fuels and optimized powertrains for maritime propulsion applications.

Transformation to sustainable energy systems

Using this methodology, system designs with different technologies for different use cases can be optimized in early project design phases. The core of the methodology comprises dynamic optimization approaches as a basis for finding sophisticated control strategies and improving the operation of the system. Extending the methodology with machine learning techniques to hybrid approaches will enable prediction of energy demand, price and availability of renewable energy sources for power generation. Furthermore, possible use cases can be extended by model predictive controls for real energy systems and digital twins. For the further development of the methodology with regard to hydrogen applications, a cooperation with the Hydrogen Center Austria (HyCentA) was established.

First successful application

The methodology was tested for the first time at INNIO Jenbacher. "We are pleased to have found a competent partner in the LEC, with whom we can further develop our gas engine technology towards a climate-neutral, greener and safer energy future. At the same time, the LEC supports us in identifying all opportunities for further CO2 emission reductions at our Jenbach site. By 2030, we want to reduce greenhouse gas emissions at the Jenbach site by 50%. We have simulated the scenarios for this with LEC ENERsim," says Dr. Stephan Laiminger, Chief Technologist at INNIO Jenbacher.



Three stages of energy system optimization, Copyright © LEC GmbH

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This success story was provided by the centre management for the purpose of being published on the FFG website. The COMET-Center LEC EvoLET and the COMET-MODULE LEC HybTec are funded within the COMET – Competence Centers for Excellent Technologies Programme and funded by BMK, BMDW and the province of Styria. The COMET Programme is managed by FFG. Further information on COMET: www.ffg.at/comet