Brandenburgische Technische Universität Cottbus-Senftenberg
Lehrstuhl Leistungselektronik und Antriebssysteme
Prof. Dr.-Ing. Georg Möhlenkamp

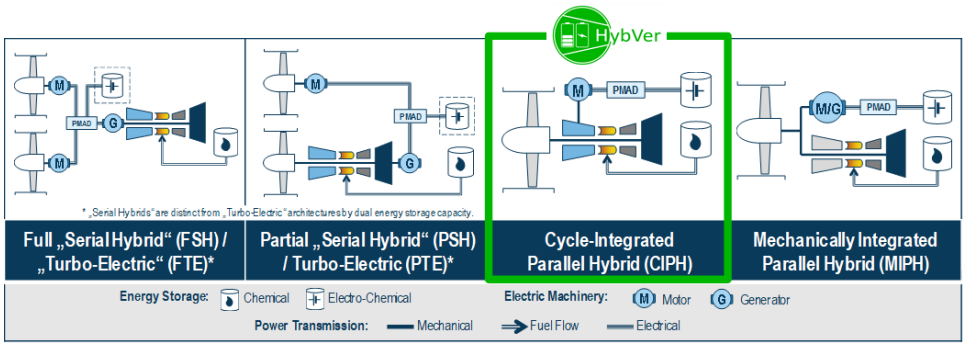
Project Name: Hybridized Compressor Concepts (HybVer)

Project Duration: September 2022 – August 2025

The project is funded by the Aviation Research Programme LuFo VI-2 under the Federal Ministry for Economic Affairs and Climate Action. Grant Number: 20E2111C

Objective of the project:

The aviation industry, a significant contributor to global carbon dioxide (CO_2) emissions, faces increasing pressure to adopt greener technologies and reduce its environmental footprint. Electrification is emerging as a transformative solution, offering the potential to lower CO_2 emissions by incorporating fully or partially electric propulsion systems. One innovative concept is the Cycle-Integrated Parallel Hybrid (CIPH) turbo-shaft engine, which integrates electrification into either individual compressor stages or entire compressor sections.



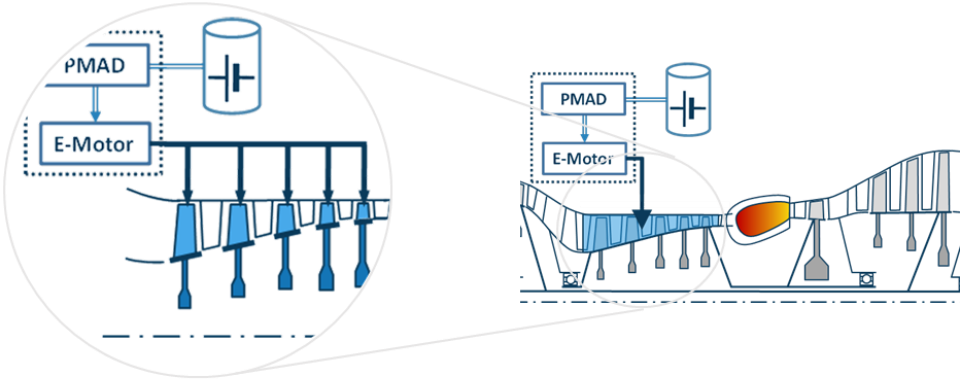
Picture: Classification of Hybrid Propulsion Systems

The joint research project "Hybridized Compressor Concepts" (German: Hybridisierte Verdichterkonzepte – "HybVer") aims to advance this technology. The project explores the concept of electrically driven compressor rotor rows, stages, or stage compounds within the engine, enabling them to operate independently of gas turbines. This novel approach not only optimizes efficiency but also has the potential to significantly reduce emissions.

The primary goal of the HybVer project is to achieve Technology Readiness Level (TRL) 2 for the proposed hybrid compressor technology. Researchers will assess its performance in terms of flight efficiency and emission characteristics for aircraft types best suited to hybrid-electric propulsion systems. The project addresses critical research areas, including aerodynamic and operational behavior of hybridized compressors, integration of advanced electrical system components, mechanical and compressor design, and conceptual integration at both propulsion system and aircraft levels. By consolidating knowledge in these areas, the project aims to outline key technological requirements and prepare a detailed technology development plan, setting the stage for a potential market introduction by 2035.

The joint partners of the project are: Bauhaus Luftfahrt e.V, Technical University of Berlin (Chair of Aero Engines), and Technical University of Munich (Institute of Turbomachinery and Flight

Propulsion). Together, partners are driving development and integrated evaluation of hybridized turbo compressor concepts.



Picture: HybVer Concept

Focus of BTU in the project:

The Brandenburg University of Technology (BTU) Cottbus-Senftenberg, Chair of Power Electronics and Drive Systems focuses on the development of the electrical drive system for hybrid-electric compressor integration. Key research activities at BTU include:

- Selection of optimal hybrid-electric compressor concepts
- Potential analysis of electrical components, considering advancements in power and energy density over the next 5–10 years
- Development of computer-aided methods to rapidly determine ideal parameter ranges for electrical components
- Detailed study and design of electric motors for compressor integration
- Comprehensive design of the entire electric drive system for aviation applications
- Design improvements tailored to meet the requirements of the aviation industry

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Contact Information

Head of Chair of Power Electronics and Drive Systems:
Prof. Dr.-Ing. Georg Möhlenkamp

Project Contact Person:
M. Sc. Yinghui Yang

Logo:

Funded by: