FlyECO

FUTURE ENABLING TECHNOLOGIES FOR HYDROGEN-POWERED ELECTRIFIED AERO ENGINE FOR CLEAN AVIATION

Project Coordination: Dr. Stefanie de Graaf, DLR Institute of Electrified Aero Engines

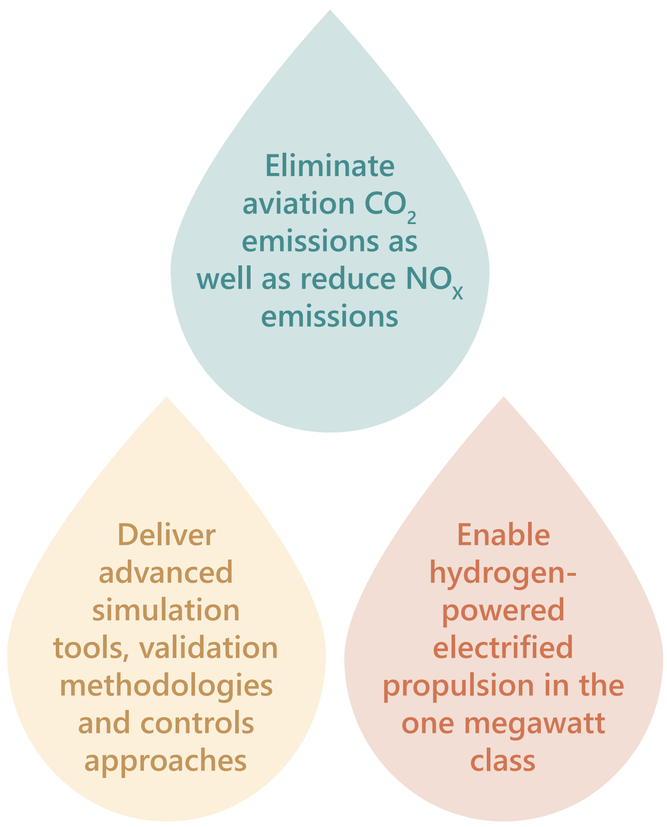
JAN 2024 - DEC 2026 || 3.5 MIO € + 0.5 MIO € (UK PARTNER) || 6 INSTITUTIONS

Motivation

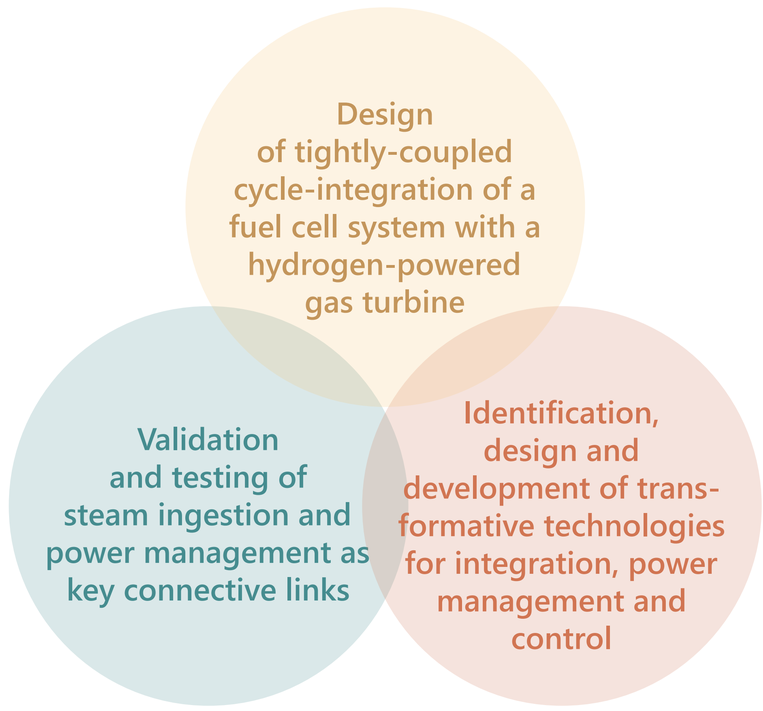
A SUSTAINABLE FUTURE WITH LOW-EMISSION AIR TRAVEL

Aviation's carbon footprint poses a critical challenge to global sustainability, with emissions soaring as air travel becomes increasingly prevalent. Traditional jet engines burn fossil fuels, releasing CO_2 and NO_X into the atmosphere, exacerbating climate change. The urgency to decarbonise this sector is palpable, demanding innovative solutions to curb its environmental impact.

With this in mind, the EU-funded FlyECO project offers a pathway to low emission air travel and sustainable growth. Through the integration of innovative technologies such as an solid oxide fuel cell (SOFC) system with a hydrogen-powered gas turbine (GT), the project targets a 50 % reduction in NO_X emissions while eliminating CO_2 emissions altogether. The project's simulation framework will assist in refining the integrated power and propulsion system (IPPS) architecture and enable advancements towards real-world implementation. FlyECO will focus on commuter/regional aircraft class propulsion system.



Key Outcomes



Project Goals and Objectives

Simulation and evaluation of the dynamic performance of GT, SOFC and batteries in a tightly coupled cycle-integrated hydrogen-based propulsion system of one megawatt.

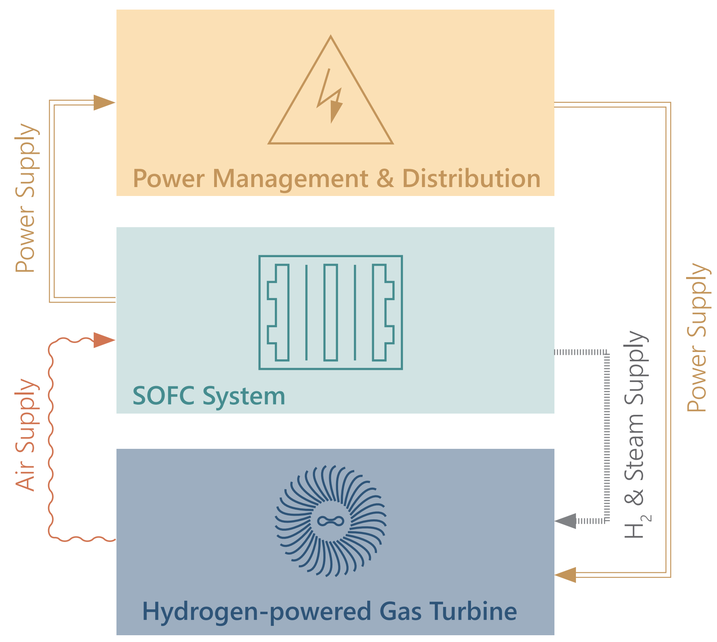
Develop and mature necessary, transformative technologies for the coupling and the integrated operation of an airborne hybrid power and propulsion system of GT and SOFC.

Development of an overall controls approach to optimize power management and distribution of the IPPS and its validation in cyber-physical demonstrator of GT and SOFC coupling.

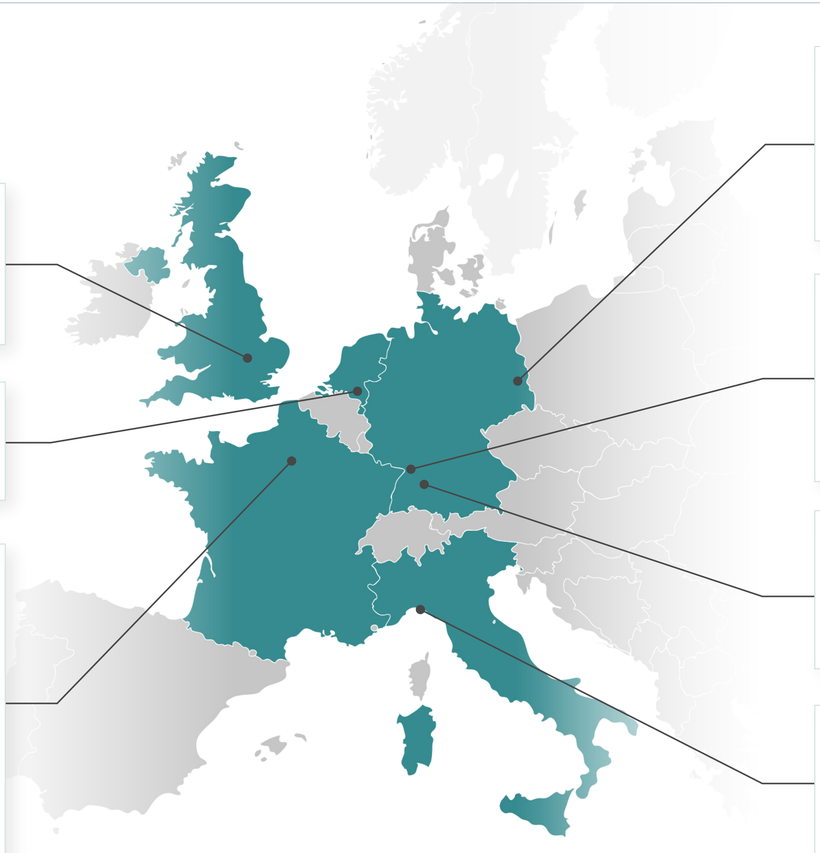
Cyber-physical demonstration for validation of TLR 3 of hydrogen combustion with steam ingestion to achieve zero CO_2 emissions and at least a 50 % reduction in NO_X emissions.

Contribution to Horizon Europe impact assessment, technical Committees, the Governing Board of the Clean Aviation and Clean Hydrogen partnerships, as well as the scientific community with a technology roadmap for GT-SOFC hybrid systems and open-access publication of datasets and models.

IPPS



Consortium & Competencies



Cranfield University Bedford
- Design and performance analysis of hybrid GT for IPPS
- Local controller design for hybrid GT
- Design and control of electrical components and system

Eindhoven University of Technology Eindhoven
- Development of optimization models and optimal control strategies for energy and power management

Safran SA Paris
- Elaboration of requirements for GT, the SOFC system, control strategies, and testing
- Design of IPPS architectures to optimise performance and efficiency
- Development of a comprehensive 1MW+ IPPS simulation environment aimed at exploring optimised component synergies

German Aerospace Center (DLR-EL) Cottbus
- SOFC system integration with GT and design of critical components
- real-time capable modelling and HiL simulation
- Coordination and external communication

Karlsruhe Institute of Technology Karlsruhe
- SOFC testing for model development and parameterization
- Development of a design flexible SOFC model - Simulation of SOFC performance
- Model based evaluation of SOFC designs regarding airborne applications

German Aerospace Center (DLR-VT) Stuttgart
- Modification of test rigs to meet requirements of scaled demonstrator testing
- Performance of high-pressure combustion test

University of Genoa Genova
- SOFC system simulation in different conditions
- Support in the development of general requirements, system design, control system and dissemination activities

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