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RESEARCH DAYS
15-16 NOVEMBER

Flex4H2 Flexibility for Hydrogen

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Project Overview

Call year: 2022

Call topic:

HORIZON-JTI-
CLEANH2-2022-04-
04

*“Dry Low NOx
combustion of
hydrogen-enriched
fuels at high-
pressure conditions
for gas turbine
applications”*

Project dates:
Jan'23 - Dec'26

Total project budget:
8.7 M€

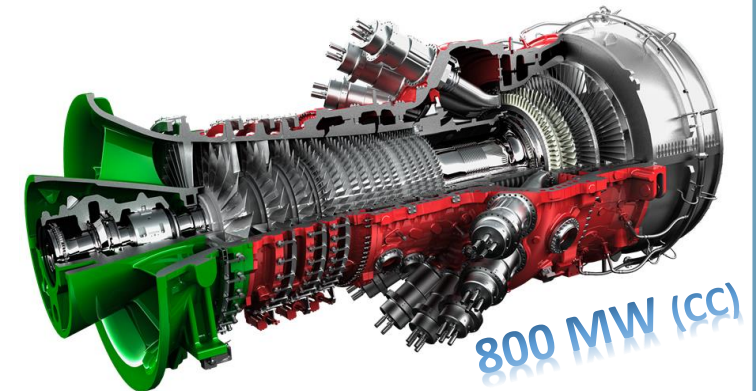
Flex4H2

% stage of implementation
01/11/2023: 25%

**Clean Hydrogen Partnership max.
contribution:** 4,178,517.25 €
Switzerland: 4,012,475.00 CHF



Project Summary



H2 combustion system design and development

- FLEX4H2 will develop and validate a **safe, efficient and highly fuel-flexible combustion system** capable of operating with any hydrogen concentration up to **100% H₂**, at H-Class operating temperatures, while still meeting **emission targets** without any use of diluents.



Validation and demonstration

- The combustion system will be **validated with up to 100% H₂ at full gas turbine operating conditions**. The full-size combustor prototype will undergo dedicated atmospheric and high-pressure testing up to Technology Readiness Level (TRL) 6.

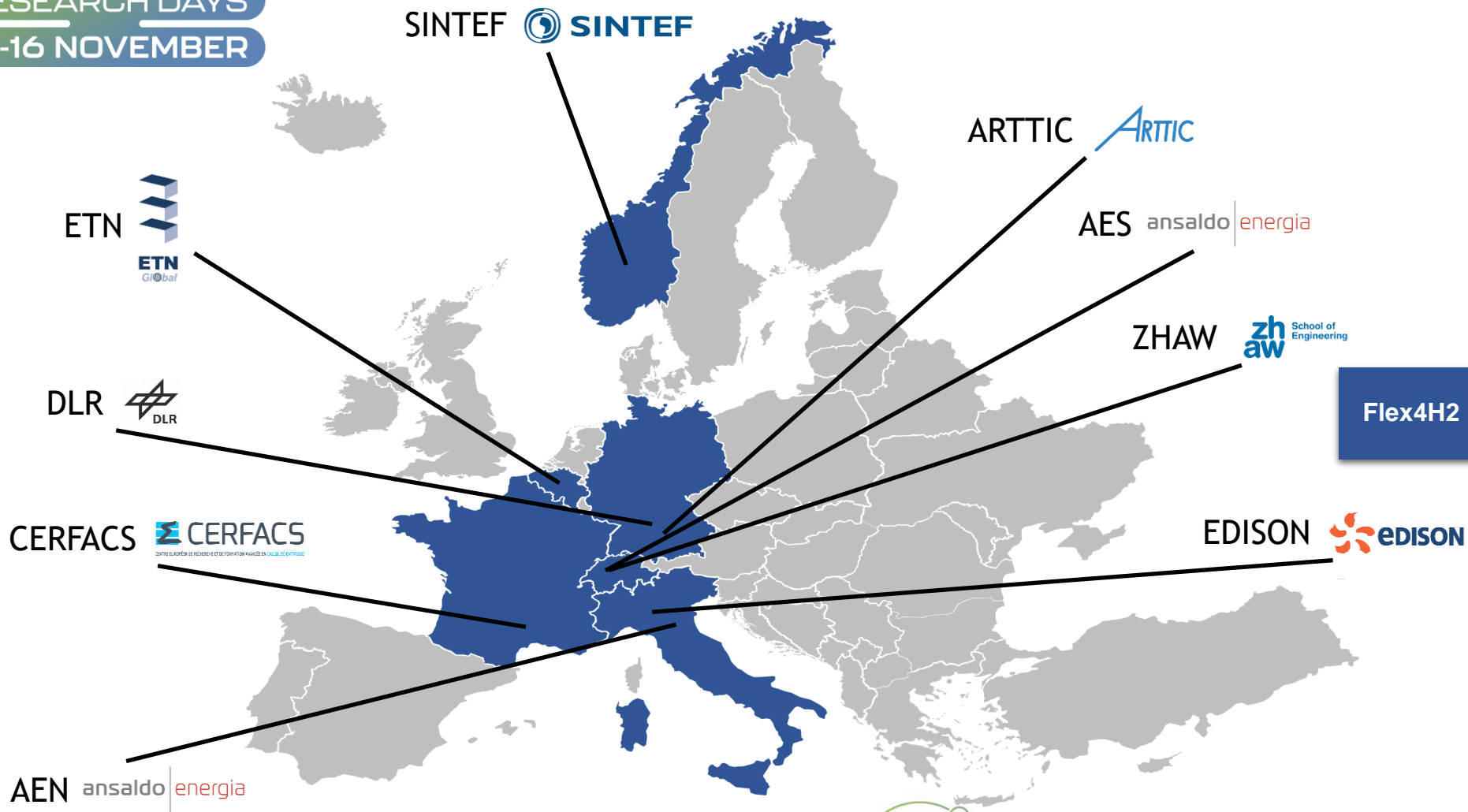


Pathways presentation

- The FLEX4H2 project will provide credible pathways for comprehensive **exploitation of the project's results** and thereby providing the basis for a firm contribution to the EU Green Deal towards decarbonization of the electric power sector by 2030 and beyond.

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Partners



Flex4H2

WP1 (AES)
Combustion System Development and Refinement

WP2 (SINTEF)
Numerical Modelling

WP3 (ZHAW)
Thermo-acoustics

WP4 (AEN)
Testing & TRL6 Demo

WP5 (ETN)
Communication, Dissemination & Exploitation

WP6 (AI+AEN)
Project Management



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Project Progress - Fuel Flexibility

SoA at PROJECT START:
0-50%v. H2 in CH4

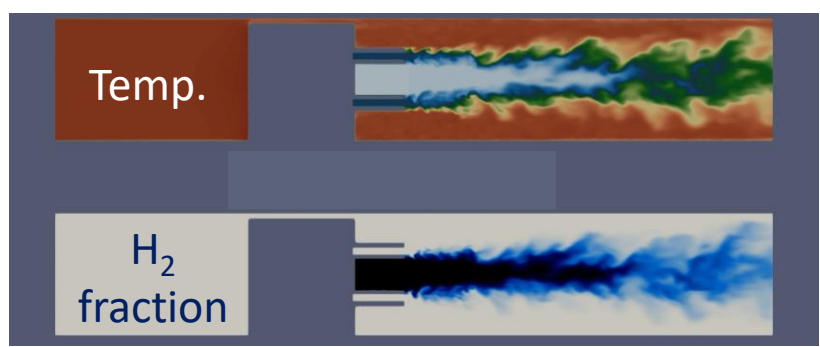


PROJECT TARGET VALUE:
0-100%v. H2 in CH4

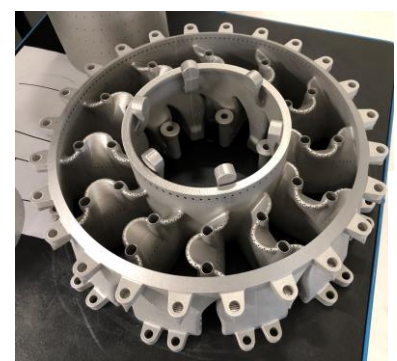
25% 50% 75%

Key achievements to-date:

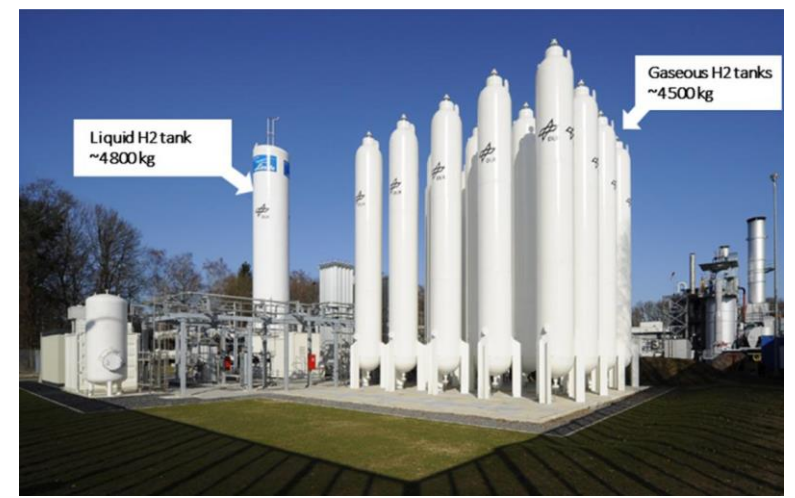
- New HW designed, manufactured and tested at atm. & high pressure
- 0-70%v. achieved at full engine conditions
- 70-100%v. achieved with derating



Numerical simulations



Prototype manufacturing



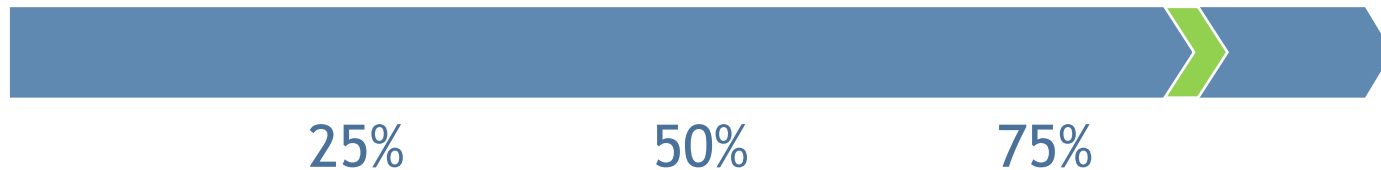
High pressure testing facility



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Project Progress - Ignition

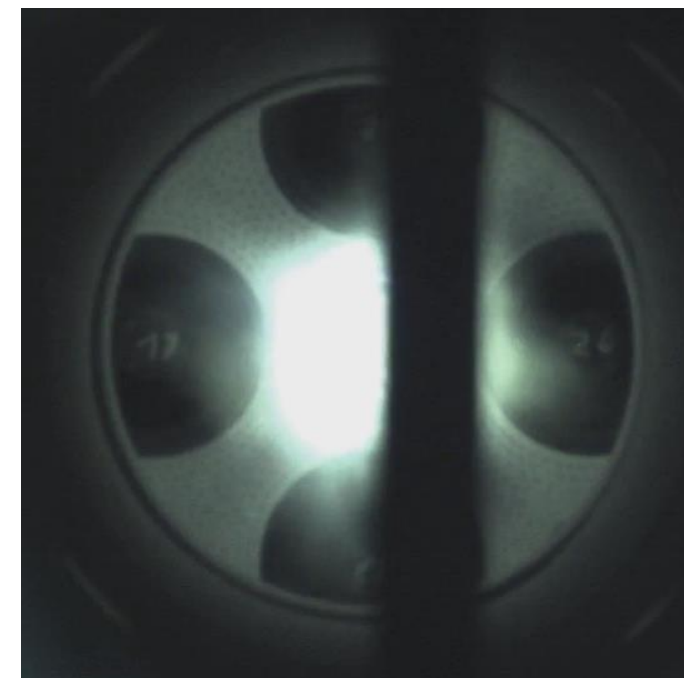
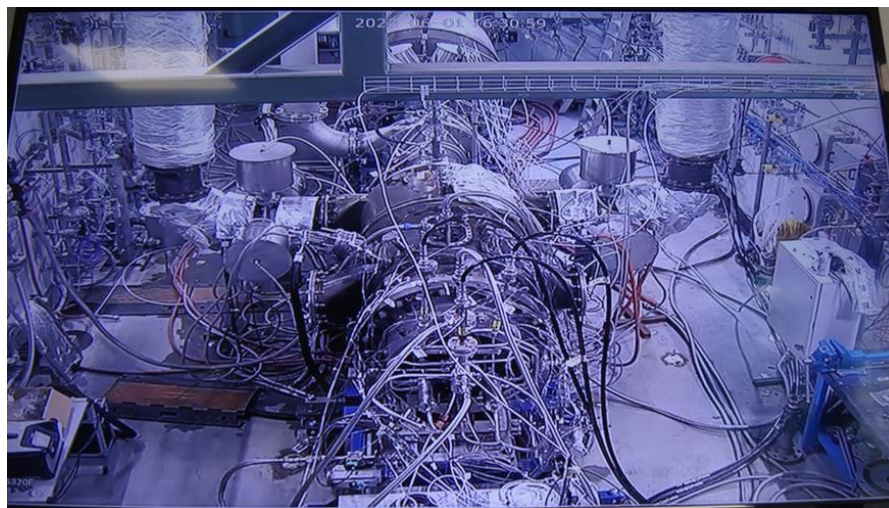
SoA at PROJECT START:
0-20%v. H₂ in CH₄



PROJECT TARGET VALUE:
0-100%v. H₂ in CH₄

Key achievements to-date:

- Ignition tested with up to 100% H₂



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Exploitation Plan/Expected Impact

Exploitation

Five Key Exploitable Results (KERs), whose exploitation potential, patentability & marketability is assessed

- Improved combustor design for 100% H₂ operation
- H₂ combustion prediction methods
- Mitigation concept for stable combustor operation
- Validated full-scale combustor prototype
- Technology roadmap



Impact



Contribution to Net Zero pathway

FLEX4H2 project offers a significant contribution towards the decarbonization of the electric power sector.



Accelerating the transition phase

Solutions will be offered for full-scale gas turbine combustors retrofitable also to other non-OEM GTs with can-type combustors.



New combustor technology

The combustion system will handle blends of natural gas with up to 100% of H₂, without use of diluents and power derating.



Efficient grid balancing

H₂-fueled gas turbines carry significant potential to fill in the gaps caused by RES intermittency and unpredictability.



Re-utilization of existing assets

Absence of strict requirements concerning fuel gas purity makes it possible to reuse the current infrastructure and thus reduce investment costs.



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Communication Activities

- Marketing activities
- Journal publications
- Magazine articles
- Results distribution among stakeholders
- Conference contributions
- Events organization (conferences, workshops)

Leaflet



Poster



Roll-up



Project website



LinkedIn



X



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Dissemination Activities

Events:

- ETN Global Annual General Meeting & Workshop – Mar'23 – 200 participants
- 11th International Gas Turbine Conference – Oct'23 – 165 participants

Publications:

- ETN Global [Quarterly Newsletter](#) – Aug'23 – 1700 recipients
- Article published in [Gas Turbine World](#) magazine - Oct'23
- 3 article abstracts submitted for ASME Turbo Expo'24



R&D PROJECTS

Interview with Andrea Ciani and Vasileios Stefanis from Ansaldo Energia: FLEX4H₂ project coordinators




Ansaldo Energia is leading two work packages and is responsible for the development of the combustion system design enabling operation with natural gas, hydrogen and every blend in between. Additionally, Ansaldo Energia will develop the design for manufacturing and coordinate the production of combustor prototype hardware, as well as their tests and validation.

What are the main goals of the FLEX4H₂ project?

The FLEX4H₂ project fully supports the Paris agreement and EU Green Deal climate targets. In this context, utilisation of hydrogen offers a unique chance to decarbonise the power generation sector reliably, independently from weather or seasonal conditions, contributing to the ongoing effort in the fight against climate



Thank you!

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