

Hydrogen Research & Innovation Days

24-25 November 2025



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HyCoFlex Project

Hydrogen for Clean Heat and Power

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HyCoFlex Lighthouse Project

Introduction



Smurfit Westrock SGT-400 Cogeneration Plant
Saillat-sur-Vienne, France

- Siemens Energy led consortium EU & UK R&I funded
- Project Duration: February 2024 – April 2027
- Partners include: Engie, Centrax Ltd., Siemens Energy, Equinor, Smurfit Westrock, Arttic, German Aerospace Center, National Technical University of Athens
- Utilizes and advances the infrastructure of the HYFLEXPOWER project

Decarbonizing recycling papermill by modernizing cogeneration plant in Saillat-sur-Vienne, France.

Demonstration of the power-to-H₂-to-power **cogeneration plant** with an **H₂ gas turbine** for flexible operation with **NG/H₂ fuels up to 100% H₂**.

SIEMENS ENERGY

equinor

DLR

ARTTIC BY PNO GROUP

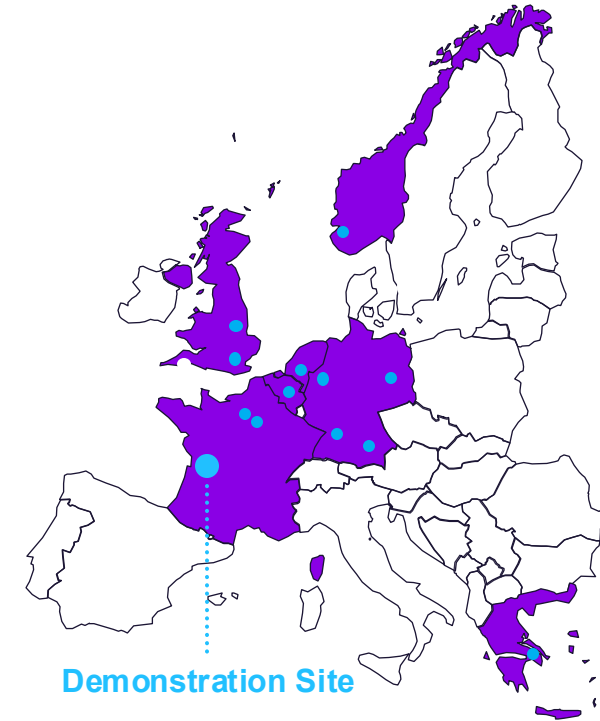
ENGIE

CENTRAX

Smurfit Westrock

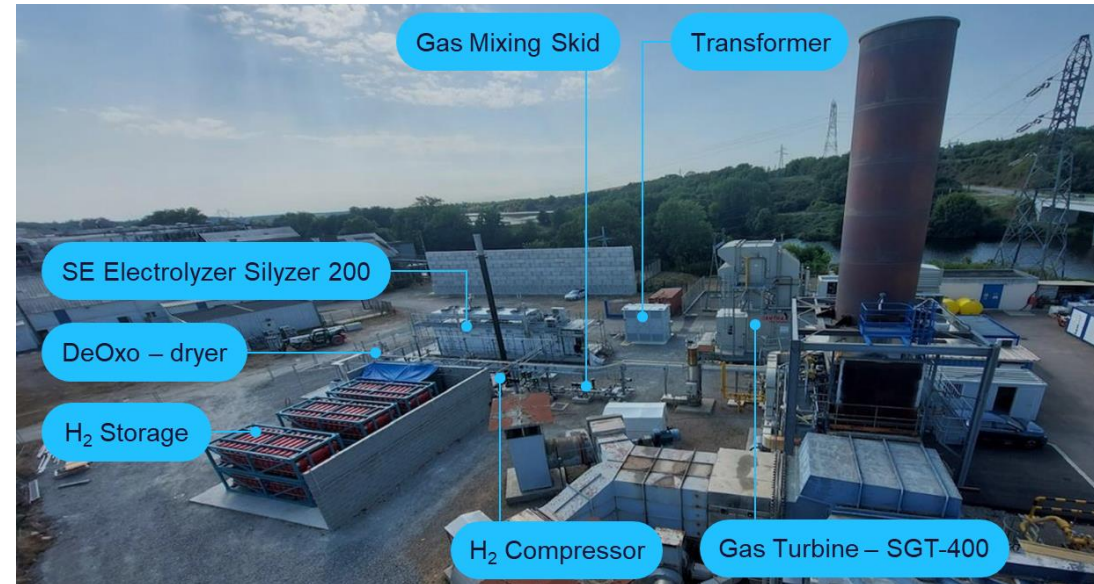
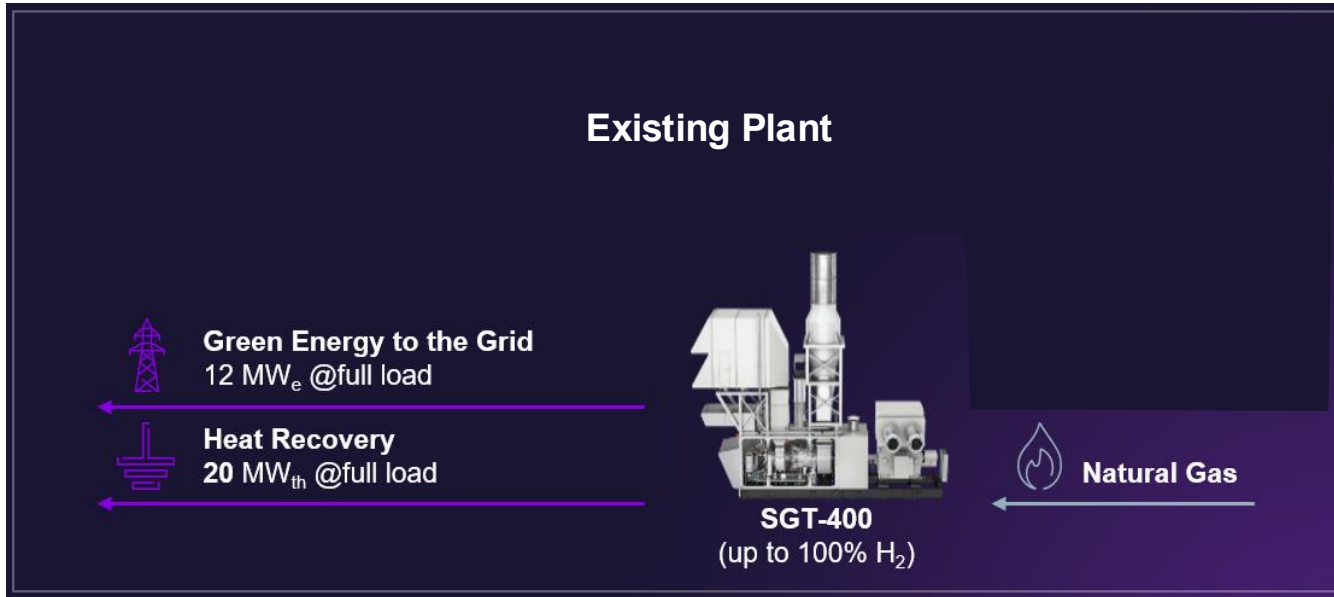


National Technical University of Athens



Customer, academia and industry formed strong consortium demonstrating CO₂-free power generation

Advanced Power-to-H₂-to-Power Plant



Milestones

2024 | Plant Upgrade ✓

- Advanced plant concept **upgrade** for **flexible operation** with NG/H₂ up to 100% H₂

2025 | Pilot Demo ✓

- Pilot demonstration of **flexible operation** with NG/H₂ blends

2026 | 100% H₂

- Pilot demonstration of **flexible operation** of **cogeneration** unit (HRSG & GT) with up to **100% H₂** (CO₂ saving 65,000t/yr.)
- Techno-economic & environmental analysis of cogeneration plant



Storage



DeOxo-Dryer



Compressor



Electrolyser



Mixing station



GT Core Engine

Development, construction, and integration of plant with hydrogen generation, storage, supply and gas turbine re-electrification technologies:

Gas Turbine

- 12MWe - H₂/NG fuel 0-100% H₂
- H₂ DLE Combustion Technology
- Package upgrade

H₂ Storage

- 57 m³, 936 kg H₂ at 200 bar

H₂ Compressor

- 35 to 200 bar

Electrolyzer

- 1 MWe – 16,4 kgH₂/h

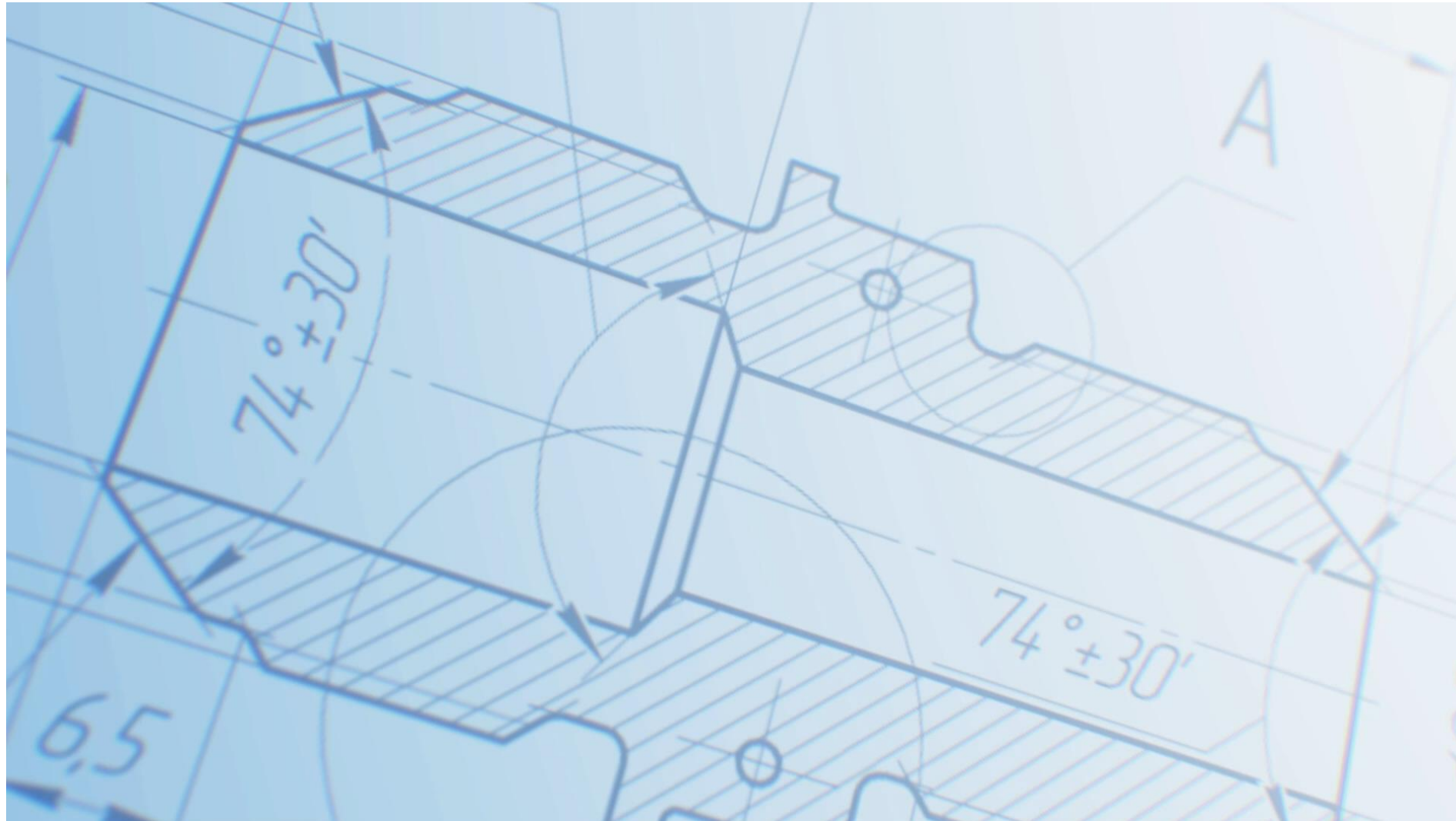
H₂/NG Mixing Station

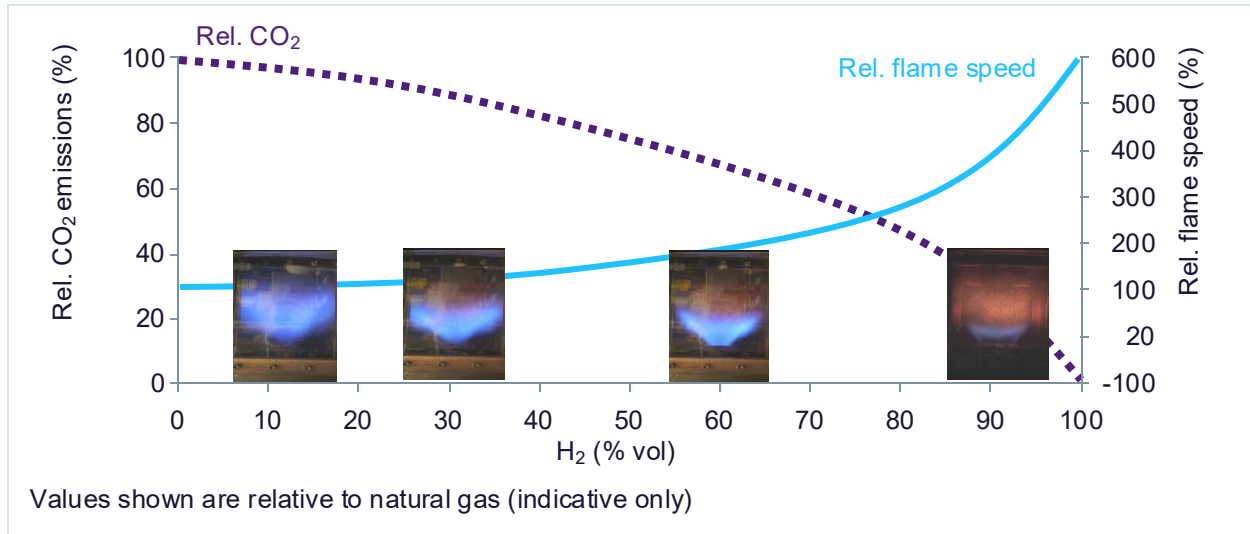
- H₂/NG fuel mixing station 0-100% H₂ up to 14.000 Nm³/h
- Upgrade for flexible GT operation

H₂ Docking Station

- 200 or 300kg tube trailer

Advanced Plant Concept Construction





Challenges

- **Higher reactivity and flame velocity** pushes flame towards burner and increases risk of explosion or flashback
- **Higher flame temperature** can lead to local hotspots if imperfectly mixed and thus increased NO_x emissions
- **Lower volumetric energy content** requires larger flows to be handled by fuel system
- **Higher diffusivity** requires changes/re-certification of sealing and flanges
- **H₂ embrittlement** requires upgrade of stainless-steel materials

DLR Stuttgart Tests

- Fundamental **Single jet** combustion tests.
- High pressure and 0-100% H₂.
- Optical access and advanced laser diagnostics.
- Flashback tests: Evaluation of surface roughness

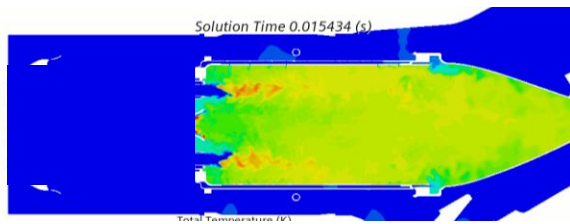
The photograph shows a highly complex industrial test rig, likely for combustion testing. It features a central stainless-steel chamber with various ports, sensors, and wiring. The rig is surrounded by blue structural supports and is illuminated with a mix of red and blue lights, suggesting a high-temperature or high-pressure environment.

HyCOFlex

High Fidelity Simulations

Full system and sector assessment

Massively parallel CFD computations including conjugate heat transfer



Automated design optimization

Enabling > 1,000 design iterations



Rapid Prototyping using AM

Additive manufacturing enables

- Monolithic and complex geometries
- Rapid prototyping for fast design iterations
- Advanced design concepts for extend flashback margin and low emissions



Iteration Loop

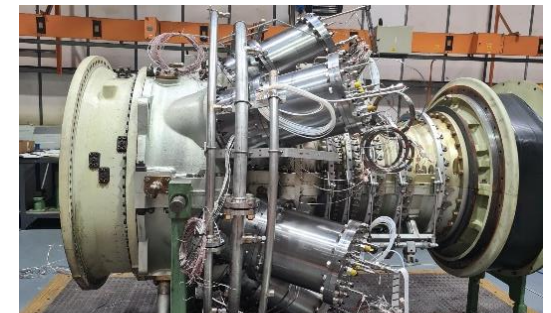
Design Validation

High-pressure combustion tests at CEC/Berlin



30+ Burner variants tested

Full engine tests in Lincoln with NG

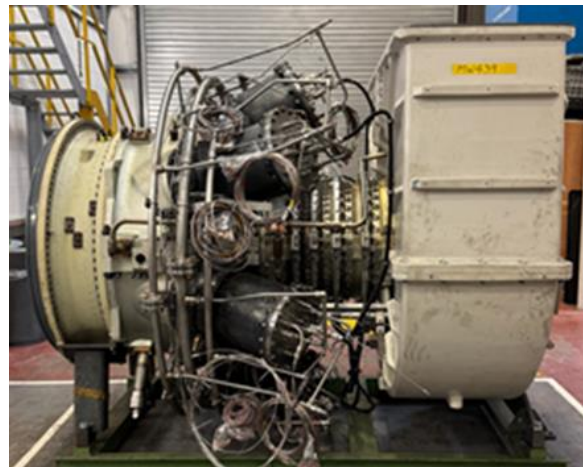


SGT-400 with DLE H₂ combustors

Developed, Demonstrated, and Validated 100% H₂ DLE Combustion Technology



Mixing station with improvements



SGT-400 build ready for 2025 test campaign

Plant Upgrade of Power-to-H2-to-Power

- Upgraded mixing station for flexible operation of cogeneration plant
- Implementation of H2 docking station

2025 Demonstration Campaign

- Demonstrator engine built with latest H2 technology and factory tested in Lincoln on natural gas
- HyCoFlex demonstration at site with NG/H2 fuel blends conducted in summer 2025
- Controllable fuel blend in mixing station achieved
- Demonstrated flexible operation with H2
 - Ramp rate $> \pm 10\%$ load/min
 - H2 fluctuations $> \pm 30\%$ vol H2/min

Next Steps

- 2026 Demonstration Campaign
 - Up to 100% H2 in cogeneration operation
 - Light-off with H2
- Techno-economic & environmental analysis of cogeneration plant
- Upscaling and replication roadmap

AM	Additive Manufacturing
BOP	Balance of Plant
CCPP	Combined Cycle Power Plant
CEC	Clean Energy Center
CFD	Computational Fluid Dynamics
CHP	Combined Heat and Power
DLE	Dry Low Emissions
GT	Gas Turbine
HKW	Heizkraftwerk (Combined Heat and Power)
HRSG	Heat Recovery Steam Generator
I&C	Instrumentation & Control
LES	Large Eddy Simulation
LGT	Large Gas Turbines
NG	Natural Gas
O&M	Operation & Maintenance
WLE	Wet Low Emissions

Thank you!



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