Clean Hydrogen Partnership

Topics in the call 2023

Hydrogen end uses: Clean Heat & Power

E. Kontonasiou, N. Lymperopoulos

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Hydrogen end uses: Clean heat & power Overview

Main Focus

- Next generation fuel cells for stationary applications able to run under 100% H_2 and other H_2-rich fuels - Reducing CAPEX and TCO
- Combustion of H_2 in retrofitted Gas Turbines

What is new

- Fundamental research on combustion of unconventional H_2 blends
- Demonstration activities on the retrofitting of burners and furnaces so that they are able to run up to 100% H_2

Clean Heat & Power - Overview

Topic		Type of Action	Ind. Budget (M€)
Fuel Cells	HORIZON-JTI-CLEANH2-2023-**04-01**: Development and validation of high power and impurity tolerant fuel cell systems ready to run on industrial quality dry hydrogen	RIA	4
Gas turbines, boilers and burners	HORIZON-JTI-CLEANH2-2023-**04-02**: Research on fundamental combustion physics, flame velocity and structure, pathways of emissions formation for hydrogen and variable blends of hydrogen, including ammonia	RIA	3
	HORIZON-JTI-CLEANH2-2023-**04-03**: Retrofitting of existing industrial sector natural gas turbomachinery cogeneration systems for hydrogen combustion	IA	6
	HORIZON-JTI-CLEANH2-2023-**04-04**: Hydrogen for heat production for hard-to-abate industries (e.g. retrofitted burners, furnaces)	IA	6

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HORIZON-JTI-CLEANH2-2023-04-01: Development and validation of high power and impurity tolerant fuel cell systems ready to run on industrial quality dry hydrogen

Efficient and reliable high power output systems operating on industrial quality hydrogen (TRL 3 → 5)

- Renewable hydrogen fueled fuel cell system: ≥100 kW, operation with industrial quality dry hydrogen (95% pure), customised for various applications, modular design, impurity tolerant, >5,000 hours validation (cold ironing of ships and ground power supply in ports are potential use cases)
- Electrical efficiency of the system 52%, 98% availability, CAPEX 2,000 €/kWe (100 MWe/annum production volume)

HORIZON-JTI-CLEANH2-2023-04-02: Research on fundamental combustion physics, flame velocity and structure, pathways of emissions formation for hydrogen and variable blends of hydrogen, including ammonia

Fundamental knowledge about unconventional hydrogen blends combustion in Dry Low Emission (DLE) gas turbines (TRL 2 → 4)

- Gaining insights of unconventional hydrogen blends combustion (like $NH_3/H_2/N_2$ blends)
- Assessment of the technological feasibility, safety, and risk of using new blends in DLE gas turbines for power generation and transport applications, including environmental, social, and economic risk/benefit balance
- Preparing gas turbines to run on 100% hydrogen, maintaining low NO_x and N_2O emissions, while enhancing gas turbine ability to handle hydrogen content fluctuations (>±15% H2/min)

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HORIZON-JTI-CLEANH2-2023-04-03: Retrofitting of existing industrial sector natural gas turbomachinery cogeneration systems for hydrogen combustion

Decarbonizing power generation from gas turbines → GT able to burn up to 100% H_2 (TRL 5 → 7)

- Enhancement of gas turbine flexibility, H_2 content in gas turbine fuel in the range 0 – 100%vol, H_2 fuel content during the start-up phase up to 100% vol, etc.
- Targeted gas turbine size for cogeneration applications is at least 10 MW_e, 60 (not continuous) fired hours
- Field test, safety plan, sustainability and circularity, legislative barriers, synergies

HORIZON-JTI-CLEANH2-2023-04-04: Hydrogen for heat production for hard-to-abate industries (e.g. retrofitted burners, furnaces)

Towards 100% hydrogen-fired industrial burners and furnaces to provide high temperature heat (TRL 5 → 7)

- Develop and validate an integrated hydrogen burner system within heating furnaces in energy intensive industrial applications; focus on flame monitoring, buoyancy effects, flame stability & flashback, emissions, odorants, colourants
- 100% fossil fuel substitution, NO_x emissions < legislation, maintain the quality of the final products
- Demo: period >6 months, operating for at least 100h at 100% H_2, furnace thermal output >1 MW_{th}
- Field test, safety plan, sustainability and circularity, synergies

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