

A clean way to power homes off the electricity grid

The Fit4Micro consortium is delighted to introduce its first newsletter edition.

This newsletter reports the latest news and developments of the project that have occurred up to July 2023 including what was presented at the EUBCE 2023.

Fit4Micro - Clean and Efficient microCHCP by microturbine based hybrid systems, is a Horizon Europe project aiming at developing a highly efficient microCHCP hybrid system running on sustainable liquid biofuels and able to provide renewable heating, cooling and power production.

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1. INTRODUCTION TO THE PROJECT

Today, the current renovation rate of existing buildings is low, risking substantial delays to achieving the EU's CO₂ reduction targets. Moreover, the energy demand in the European building sector is very diverse, and the differences in seasonal demand and local energy infrastructure are an additional obstacle to the transition towards a sustainable building sector. The European building sector is hard-to-decarbonise: almost 80% of existing buildings have to reach net-zero emissions by 2050, in order to meet the EU objectives in terms of GHG emissions. Flexible solutions are required for adapting the building sector to climate change requests and increase the use of renewables.

The overall objective of the Horizon Europe Fit4Micro project is to implement a microCHCP hybrid heating and cooling system running on sustainable liquid biofuels for domestic usage,

in order to increase environmental sustainability of the building sector.

The technology developed by Fit4Micro will significantly increase the socio-economic and environmental sustainability at household level: as highlighted in the Renovation Wave Strategy of the European Green Deal, renovating buildings is fundamental in order to reach the European Green Deal objectives, since it presents an opportunity in terms of decarbonisation, improving energy efficiency, empowering consumers and boosting the local economy.

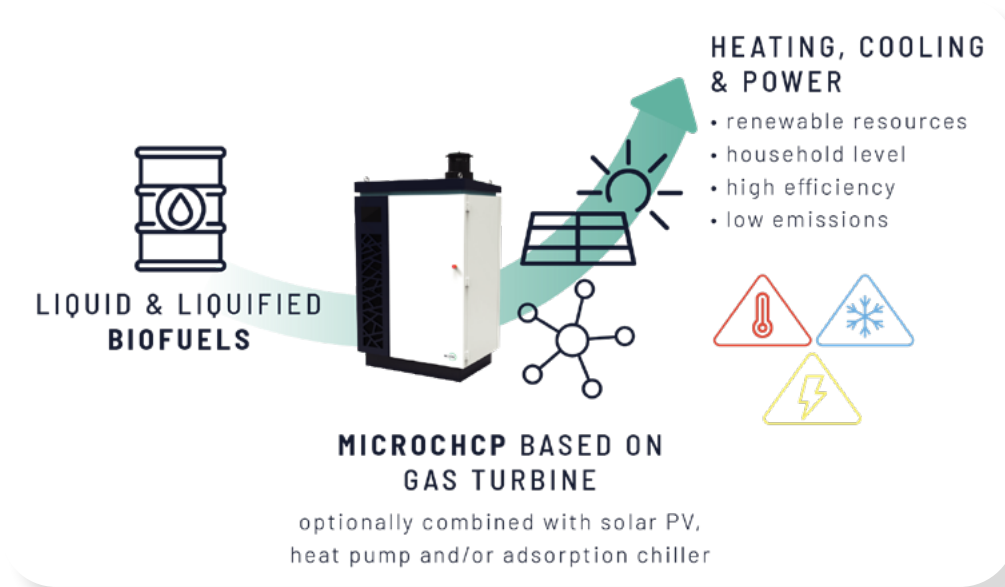
The main aim of Fit4Micro is to design a technology for stand-alone (off-grid) applications, running on RED2 compliant biofuels.

The system will comprise a double shaft micro

gas turbine (mGT) and a humidification unit. This unique combination is expected to drive high electrical efficiencies (>40%) and have a very flexible heat-to-power ratio. The heat can also be used in order to produce cooling by means of

adsorption chillers.

“By the end of the project, our aim is to build an integrated demonstrator to validate technology in relevant environment (TRL-5)”, says Michel Delanaye, the project coordinator and CEO of MITIS.



The Fit4Micro technology and concept.
Source: Fit4Micro project

2. THE FIT4MICRO TECHNOLOGY

The technology developed in Fit4Micro is based on a hybrid microCHCP microturbine unit, namely the innovative Intercooled Regenerative Reheating Gas Turbine (IRRGT) prototype from MITIS, which works with flameless combustors that can achieve very low emissions and high fuel flexibility. This turbine will be improved during the project implementation, aiming at increasing its current design efficiency from 29.6% to 40%.

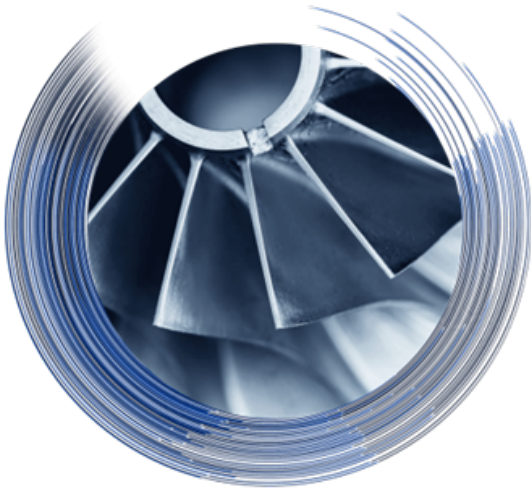
In the long run, one of the main expected outcomes is the availability of renewable fuels for domestic usage. Another important key result will be the launch on the market of the first low power two stage microturbine, with efficiency larger than 35%.

Within this process, an important phase is the one concerning the identification of resistant materials and combustors for the turbine, that will also comprehend several test campaigns for assessing its performance and optimizing its technology.

The combustion research phase has already begun, during the first 3 months of the project, the operating parameters of the combustor have been defined.

OWI Science for Fuels has carried out the first combustion tests within their labs, where the combustor parameters have been adapted according to the optimization of the micro-gas turbine. In the meantime, two combustion chambers have been developed at MITIS and will be further optimized, for the high and the low-pressure stages, respectively. Initially, the tests are carried out with natural gas, to then be performed with the Hydrotreated Pyrolysis Oil (HPO) implemented by BTG.

Once the investigation of the flameless combustor concept will be completed, two new generation combustor prototypes will be developed, one configured for low pressure stage and one for high pressure stage.



The Fit4Micro microturbine.
Source: Fit4Micro website

These two prototypes will be sent to OWI for the evaluation in their test facility, in order to implement one of the most relevant elements of the microCHCP technology developed in Fit4Micro, namely the resulting operating parameters of the combustor.

For further information, D3.1 is on “Operating parameters combustor” and Factsheet #1 is on “Flameless combustion for liquid fuels development and high temperature material assessment”, available here:

fit4micro.eu/results

3. EUROPEAN BUILDING SECTOR AND FIT4MICRO

Today, European buildings represent a hard-to-decarbonise sector. This sector still accounts for a fossil fuel dependency of 75%. In addition to that, 36% of the total amount of GHG emissions are due to the building sector.

The current annual amount of deep renovations in residential buildings in the EU27 is still extremely low, ranking around 0.2% and hence risking substantial delays to the achievement of EU’s CO₂ reduction targets.

Moreover, the energy demand in the European building sector is very diverse, and the differences in seasonal demand and local energy infrastructure are an additional obstacle to the transition towards a sustainable building sector. Within this context, almost 80% of existing buildings have to reach net-zero emissions by 2050, in order to meet the 2050 objectives in terms of GHG emissions.

As a consequence, flexible solutions are required for adapting the building sector to climate change requests: the technology designed by the Fit4Micro project will guarantee an improvement in energy efficiency rates of existing buildings, through the reduction of energy consumption and the replacement of fossil fuels with biofuels.

Another important contribution for the decarbonisation of the building sector will be given by the definition of 4 use cases of

the Fit4Micro solution: here, in particular, Fraunhofer together with the support of MITIS will define 4 use cases to assess the techno-economic performance of the hybrid combined mGT system. Among these ones, one use case model will consider the possibility of integrating the mGT with PV (Photovoltaic) or PVT (Photovoltaic with thermal collectors) within an internal DC grid, in order to allow a flexible power operation.



The building sector.
Source: Fit4Micro website

4. DISSEMINATION AND COMMUNICATION ACTIVITIES



Since the very beginning of the project, Communication and Dissemination activities have been ongoing.

The project started its communication activities with its first poster presentation at the 7th Central European Biomass Conference, in Graz, Austria.

The Conference was hosted by the Austrian Biomass Association, the Styrian Chamber of Agriculture and BEST, in cooperation with Messe Congress Graz, from 18th to 20th of January 2023.

Other than European conferences, in March Fit4Micro was presented in Dubai, where MITIS, the coordinator of the project, had a booth in the 48th Middle East Energy Conference, at the European Pavillon, showcasing its Micro-10 CHP products and disseminating the results of Fit4Micro project.



Fit4Micro poster at CEBC in Graz, Austria.
Source: ETA Florence

The main aim of Fit4Micro is to design a technology for stand-alone (off-grid) applications, running on RED2 compliant biofuels.



Fit4Micro at Middle East Energy in Dubai, UAE.
Source: MITIS

In June 2023, the Fit4Micro project attended the European Biomass Conference and Exhibition, the largest conference and exhibition in the world about biomass, held in Bologna, Italy. Here, Fit4Micro had a booth in the Exhibition area for the whole duration of the event, where project partners had the occasion of disseminating the most important information about Fit4Micro to visitors and attendees. In addition to that, the project was presented in the session “Biomass, bio-based products and bioenergy integration”, during the poster

session “Biogas, Regional Energy Transition and Renewable Heat”, focused on biomass integration in energy systems.

Michel Delanaye, the project coordinator, also introduced Fit4Micro during the workshop “High efficiency and low emissions CHP technologies from biogenic residues” organized by BLAZE, a Horizon 2020 project to develop an innovative, highly efficient and fuel-flexible technology for combined heat and power from biomass.





Fit4Micro highlights at EUBCE 2023 in Bologna, Italy: booth and project presentation in the Exhibition area.
Source: EUBCE 2023

Recently, in June 2023, the project activities were presented in another important international context: the ASME Turbo Expo Conference in Boston, USA, a Conference where global experts and turbomachinery engineering leaders from industry, academia, and government gathered to actively address the 2050 goals for a sustainable future.

For further information, D8.1 is on "Dissemination, Exploitation and Communication Plan 1", available here fit4micro.eu/results



Fit4Micro at ASME 2023, in Boston, USA.
Source: MITIS

ABOUT THE PROJECT

The core activity of FIT4MICRO is to design a technology that will guarantee an improvement in energy efficiency rates of existing buildings, through the reduction of energy consumption and the replacement of fossil fuels with biofuels.

The project has a total duration of 48 months from October 2022 to September 2026 and is funded by the European Union under the Horizon Europe programme.



FIT4MICRO is coordinated by MITIS, a clean-tech startup developing flameless combustion microturbine working with air foil bearings, with the main aim of providing immediate and drastic emission reductions during primary energy conversion. The project consortium has put together 9 partners from 5 countries with long-term expertise in renewable energy applications, from technology developments to the market implementation, including:

- two research institutions: Fraunhofer ISE and OWI Aachen (Germany);
- two industry partners: FAHRENHEIT GmbH (Germany) and MITIS (Belgium);
- two SMEs: ETA Florence Renewable Energies (Italy) and BTG Biomass Technology Group (The Netherlands);
- two universities: University of Mons (Belgium) and Aalborg University (Denmark);
- one European association: COGEN Europe (Belgium).



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Funded by the European Union (Grant n. 101083536).

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