Optimised Microturbine Solar Power system

www.OMSoP.eu

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4-year R&D Project 2013-2017

OBJECTIVE

The overall objective of the OMSoP project is to provide and demonstrate technical solutions for the use of state-of-the-art concentrated solar power system (CSP) coupled to microturbines to produce electricity. The intended system will be modular and, using different layouts, capable of producing electricity up to 30 kWe per unit. A 10 kWe unit will be built and tested for demonstration purposes. The aim is to make such a system available to provide energy needs for domestic and small commercial applications. For larger energy needs, the units can be stacked by virtue of their modular nature. It can be integrated with medium and long term energy storage and/ or co-firing with conventional fuels or biofuels. The primary technical challenge is to enable the production of small scale cost effective, efficient, reliable and easy to maintain units for either on or off-grid applications.

VISION

To pave the way for commercial deployment of cost effective, efficient, reliable and easy to maintain solar powered micro-turbine systems in the <50 kWe power range. The European Commission has recognised the potential role of CSP in Europe's low carbon energy goals, but also acknowledged the challenges associated with the technology, such as the necessary improvement in predictability and dispatchability of CSP plants. These challenges are addressed in the OMSoP Project. The novel combination of CSP with microturbine technology in this power range is a significant change to the existing "dish-Stirling" systems and is aimed at making the CSP more robust, reliable and cost effective and more suitable for hybridisation.

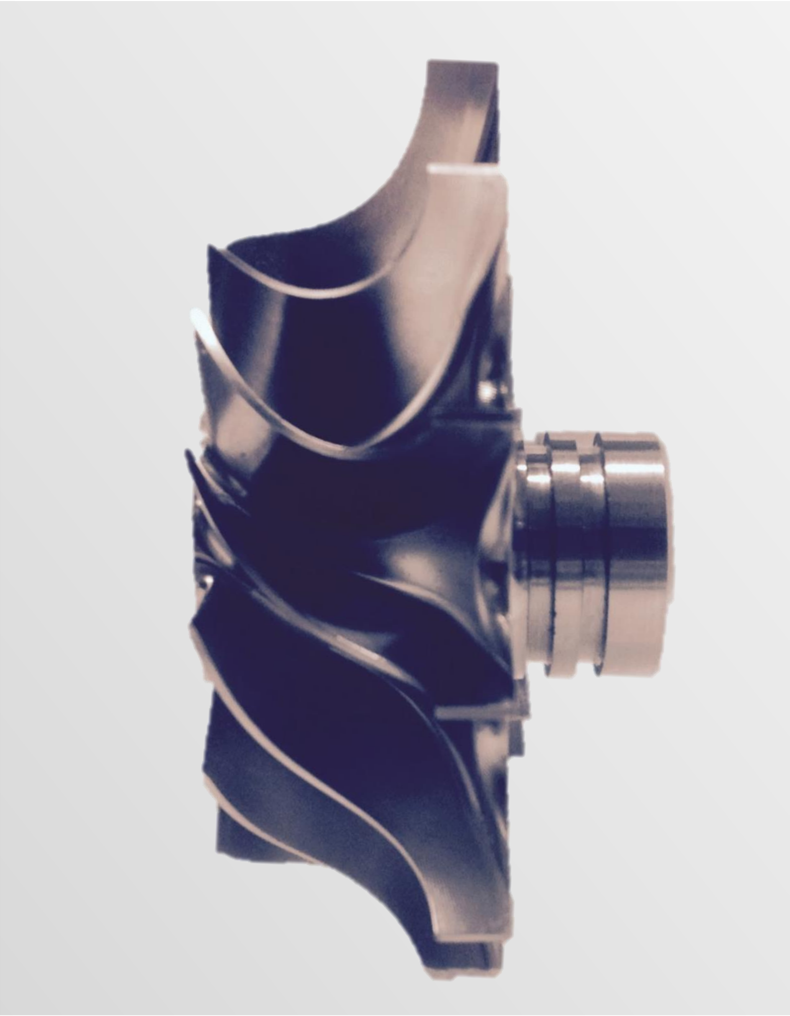
The OMSoP project brings together experts of industry and academia in close international cooperation to reduce the time and cost of bringing this technology to the market, This project is an essential stepping-stone for a future full scale demonstration of an optimised system. A successful outcome of this project will be an important step towards opening up the market for a commercial implementation of CSP coupled with microturbine technology.

STRUCTURE

The technical challenges addressed by the OMSoP project are divided into 3 Work Packages (WPs):

System Component Development (WP1)

This WP has two main tasks. First, to develop and separately test the components for a demonstration system in the range of up to 10 kWe. Originally, the microturbine would be built based on improvements of an existing system developed by Compower. However, in the course of the project, it was decided to make a new microturbine design with a wider speed operating range for the demonstration system. City, University of London has designed and built the new microturbine as well as conducted development and testing of the system. KTH has developed and tested a receiver in their Solar Lab while INNOVA has developed a solar concentrator based on their solar dish-Sterling technology. The second task was to use the acquired knowledge to develop components for an optimised microturbine solar dish system for the power range <50 kWe in future testing and deployment.

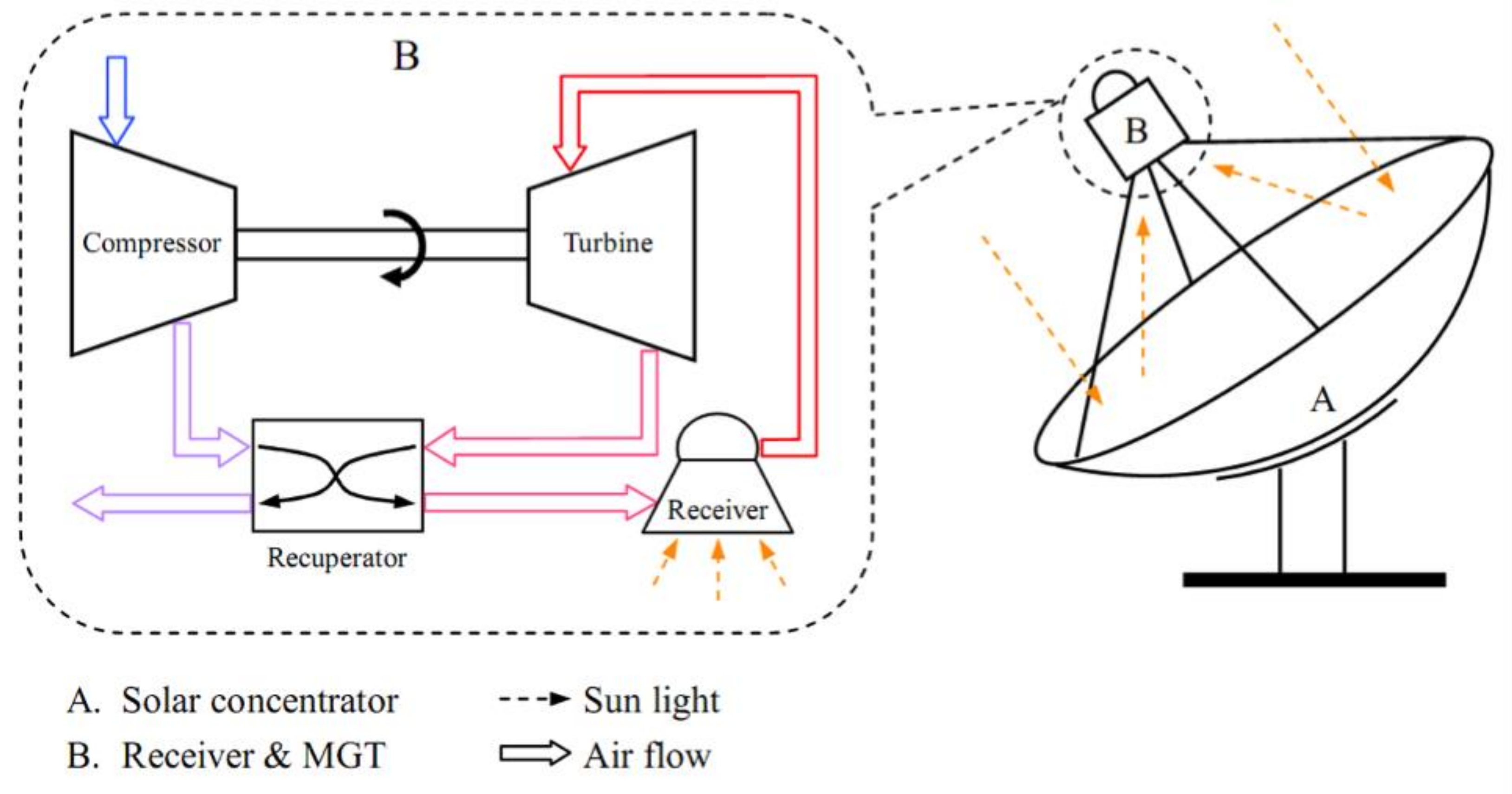


Turbine impeller for OMSoP Solar Micro Gas Turbine made of Gamma-Titanium Aluminide (γ-TiAl)

Solar dish installation at the ENEA Casaccia Centre

System Design and Integration (WP2)

There are two main tasks for WP2. The first is to define a demo plant layout, with the identification of the components operating conditions and the elaboration of reliable integration solutions through a modelling activity which is transversal with WP1. The integration work covers all the mechanical, electrical and electronic aspects. The second task consists in the realization, instrumentation and operation of the demo plant, with the objective of verifying the system performance over a wide range of operating conditions and providing useful information for components improvement and overall system optimization.



Techno-economic Analysis (WP3)

Thermodynamic and mechanical models of the system and its components will be developed and used for the analysis and design of both the demonstration system and optimised system in WP2. Further insight into future deployment will be gained by investigating hybridisation with other fuels and MGT power augmentation concepts. Market and cost analyses will also be performed in addition to uncertainty, sensitivity and risk studies to account for regional and social influences on the commercial feasibility of the concept. The above will provide crucial information to system and component development and will also provide insight into potential future deployment. Finally, a life cycle assessment will be performed to evaluate the environmental aspects and potential impact associated to the solar system.

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