

Abstract ICAE 2011 (Perugia)

Title:

Adaptation of a micro gas turbine to biofuels and preliminary tests

Authors:

David Chiaramonti^{†,a}, Andrea Maria Rizzo^a, Giovanni Riccio^a, Alessandro Cappelletti^a, Matteo Prussi^a, Francesco Martelli^a.

Affiliation:

^a CREAR and RE-CORD, c/o Department of Energy Engineering of the University of Florence, via Santa Marta 3, Florence (Italy)

Corresponding Author:

[†] e-mail: david.chiaramonti@unifi.it, tel: +39-055-4796436, fax: +39-055-4796342

Keywords:

Biofuels, micro gas turbine, vegetable oil, biodiesel, bio-oil, pyrolysis oil.

Abstract:

A Garrett GTP 30-67 micro gas turbine (25 kW electrical power) has been installed and modified at CREAR/RE-CORD facilities to allow testing with several alternative biofuels like biodiesel, pure vegetable oil and bio oil from fast pyrolysis. The MGT performances have been initially characterised with diesel oil. The modifications involved the substitution of fuel line piping and connections, sealing material and other components to withstand both increased aggressiveness and higher viscosity of biofuels, and to deal with the different physical and chemical properties of alternative fuels, such as spraying, atomization, and combustion behaviour and stoichiometric air of combustion. The engine has been instrumented for direct measurement of pressure, temperature, fuel flowrate and exhaust's gas concentration (i.e. CO, CO₂, total NO_x and NO, O₂). An in-house indirect measurement of compressor mass flow rate, based on oxygen concentration in the exhaust's gas, has been developed and its reliability discussed. An automatic data acquisition system based on National Instruments hardware and Labview software has been set up. Once modified, the engine has been operated and characterized as first on diesel fuel, with the aim to settle a reference baseline for pollutant and CO₂ emissions, fuel consumption and power delivery; then, a series of tests on biodiesel and vegetable oil from sunflower has been completed. Results of these tests are compared toward data from literature. This study has been carried out within the framework of the first Russian Federation–European Union cooperative project “Bioliquids-CHP”, co-funded under the FP7 scheme from the European Commission (EC) for the EU-members and the Federal Agency for Science and Innovation (FASI) of the Russian Federation for the Russian partners.