ING-IND/08 and ING-IND/09 TURBOMACHINERY, ENERGY SYSTEMS AND POWER GENERATION Labs

Cryogenics and Stirling Engine

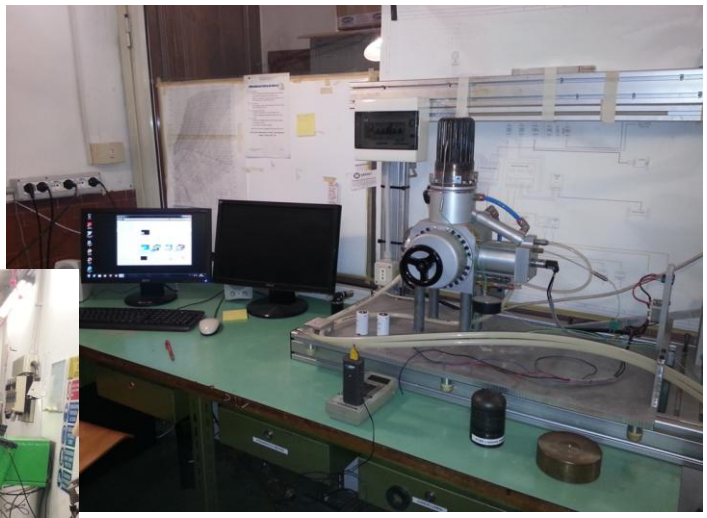
Experimental activities: the laboratory has been active for over 20 years for the study and testing of closed cycle Stirling machines. There is also a complete test-bench for the measurement of the various functional parameters and the analysis of Stirling engine cycle and cryogenic thermoacoustic machines. The lab is supplied with a National Instrument acquisition bench, a high-vacuum pump, a vacuum chamber for cryogenics (volume=3 dm^3) with a chilled water auxiliary circuit for thermal stabilization. There is also a specific library and a rich collection of Stirling machines prototypes .

Engine test room

The engine test room has three test benches, one with hydraulic brake suitable for teaching, a tilting scale for torque and power measurements; the other two benches are for eddy currents for the testing of internal combustion engines up to a power of 80 kW. Equipped with external conveyors and refrigeration circuits of flue gas it can also accommodate test-benches for Stirling machines (with 25 kW dynamo-brake) and microturbines. According to necessity can also be installed on a test bench burners up to a power of 60 kW.

Other available equipment includes a BOSCH gas analyzer, a unit for measuring the indicated cycle, and an AVL balance for the fuel.

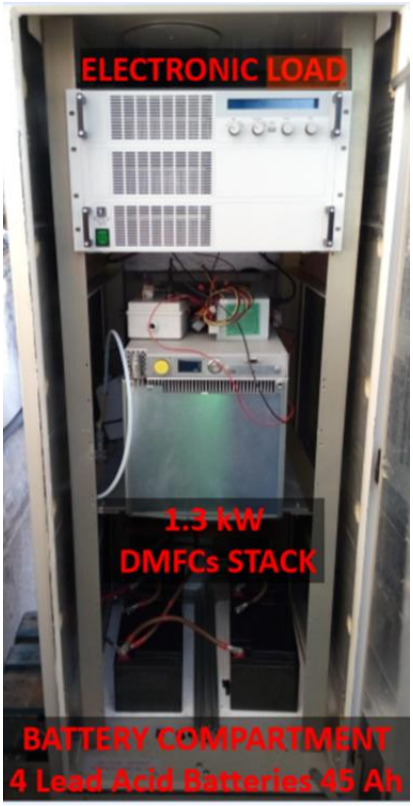
A facility for the preparation of prototypes is also available.



Biomass Laboratory

The DIMA biomass lab is equipped with a bench scale fluidized bed gasifier (10 kW). The experimental setup, shown in Figure, is mainly composed by a screw feeding system for the biomass, a bench scale fluidized bed gasifier, gas and steam supply systems, systems for the removal of the particulate from the gas, a gas cooling system and metering and analyzing systems for the gas produced. Wood-gas composition is measured with an on-line GC, while heavy hydrocarbons are sampled at regular interval and successively measured in a GC-MS. Several research activities were carried out by using the fluidized bed gasifier: a) evaluation of wood-gas from different feedstocks (i.e. changing humidity, biomass type); b) development of improved catalysts for tar reduction; c) development of efficient traps for heavy metals dispersed in the biomass; d) development of carbon capture techniques aiming at assessing negative emission schemes.

Fuel Cell Laboratory



Design, manufacturing and testing of fuel-cell based on energy conversion systems. V/I, power curves, impedentiometric analysis and contact resistance measurements for single MEA. Fuel-cell stack design testing and optimization. Design of Direct Methanol Fuel-Cell systems for APU or UPS applications. Design of PLC for fuel-cell systems. PIV analysis of two-phase flows for flow channels optimization. Testing of Direct Methanol Fuel Cell single MEA, working in passive configuration, for low power electrical devices.