

## **Progetto di Ricerca e Piano di Attività**

**Title:** *Power-to-Heat and Heat-to-Power technologies integrated with renewable generation*

**Tutor:** Prof. Andrea De Pascale

### **Research project and Plan of activities**

As part of a research activity carried out by the Energy Systems Research Group at the Department DIN of the University of Bologna, the project is primarily focused on advanced technologies of Energy System for conversion of heat into power; in particular, low-carbon solutions based on the organic Rankine cycle concept and its variants are taken into account for renewable energy exploitation, for CHP and Waste-Heat-Recovery applications. The general project topic is also focused on the thermal integration of heat pumps with heat-to-power devices, for storage of the electricity from renewable sources, in the framework of a P2H2P concept.

The specific research activity will include modelling ORC/micro-ORC systems and other components for CHP and WHR applications and possibly for P2H2P energy storage solutions. The numerical activities of the project can be based on commercial software for energy system lumped-parameter modelling approach, thermochemical fluid property database utilization and development of user-defined routines. The modelling activity will cover performance prediction, under variable input and load conditions, of the system and of components (i.e., expanders and operating fluid machines in general, with special attention - but not exclusively - to volumetric machines). The use of new environmentally-friendly working fluids can be taken into account in the study. Tests of prototypes and development of a test bench available in the University of Bologna lab will be also part of the work, in order to acquire useful data for models tuning, with a focus on low/intermediate temperature heat applications.

The candidate for this position holds a degree in energy/mechanical engineering and documented research experience on thermal storage, heat pumps, Carnot Batteries or similar technologies involving ORC systems with experimental and modelling attitude and/or familiarity with data acquisition architectures. Capabilities and skills on thermodynamic modelling (Thermoflex or similar) and data acquisition tools or hardware devices for test bench development will be considered.