Université Claude Bernard Lyon 1- Hosting offer for a MSCA Post-doctoral fellowship candidate

in the Centre for Energy and Thermal Sciences of Lyon (CETHIL)

Host Organisation	**Université Claude Bernard Lyon 1**
Department	**IUT Lyon 1 / MT2E**
Laboratory	**CETHIL UMR5008**
Website (lab / research team)	**https://cethil.insa-lyon.fr/en**
Supervisor Contact name	**Eric ALBIN**
Supervisor Contact email	**eric.albin@univ-lyon1.fr**

Host Organisation

The Université Claude Bernard Lyon 1 welcomes Marie Sklodowska Curie Postdoctoral Fellowships applications!

With 62 laboratories and more than 7000 publications per year, and leading French university in terms of the number of patents filed in collaboration with industry, Lyon 1 contributes to scientific and innovation progress in numerous fields: health, mathematics, IT, physics, chemistry, earth and space sciences, life sciences, etc. Creator of emerging knowledge and new technologies, the University is consolidating its research excellence on a global and international level by developing inter- and multidisciplinary approaches targeting the major challenges facing today society.

Host research lab/team

The laboratory CETHIL is a leading European research lab in heat transfer physics, covering a broad range of spatial and temporal scales and temperatures. Developments concern transfers at the nano and micro-scale, thermal systems engineering (components, systems and networks) and city-scale thermal engineering (buildings, urban overheating). Research generally has a strong experimental component, which is a characteristic of the unit. The lab consists of 100 people with 50% of permanent staff (35 researchers plus administrative/technical staff for research support).

The host team has several areas of research: fluid flow and transfer, thermal management and energy conversion. Fluids of interest range from Newtonian to viscoelastic fluids, and flows from incompressible to compressible ones. Composed of professors, associate professors and PhD students, the team owns expertise to make numerical and

experimental developments. One of its current activities focuses on regenerative thermal machines, with potential applications from domestic heat pumps and motors to space cryocoolers.

Hosting Offer

The **CETHIL lab** offers to host a MSCA Postdoctoral Fellowship candidate (typically a post-doc of less than 8 years research experience since PhD defence), submitting an application to the next MSCA-2026-PF call for proposals (deadline 09th of September 2026), interested to work on the following research topic:

Experimental and numerical investigation for intelligent trigeneration of energy.

The fellowship could last for 12 to 36 months, depending on the type of Postdoctoral Fellowship.

A patent [1] has recently been deposited by the supervisor to describe and protect a family of new regenerative thermal machines and the associated processes making use of innovative thermodynamic cycles for intelligent trigeneration of energy. Studies estimate that smart trigeneration systems would reduce gas and electricity bills by 40% and greenhouse gas emissions by 25% for residential applications, with even greater reductions using renewable fuels [2]. Such systems could make France and Europe more autonomous by 2040.

The concept of intelligent trigeneration of energy consists in producing simultaneously cold and/or heat and/or power from a high temperature heat source and/or electricity with the ability to adapt the production of these different energies to the demand. Regenerative thermal machines of interest have technological similarities to Stirling and Vuilleumier machines. They are thought to achieve high specific powers and efficiencies for building or industrial applications with variable energy requirements.

Supported by the National Research Agency (ANR), the supervisor has developed a modular test bench to study system components under typical conditions of industrial equipment (helium, 40 bars, etc). High performance linear motors enable to control arbitrary kinematics of piston/ displacers and generate oscillatory compressible flows in porous media and heat exchangers.

The MSCA postdoc will contribute to establish proofs of concept through two missions:

1) *the modification of the modular test bench to test the intelligent trigeneration processes at high powers*. He will use this test bench of industrial level to provide experimental data and make comparisons with modelling results (0D, 1D, CFD) [2, 3]. These comparisons

will enable high quality publications and will make numerical model more predictive to guide technological choices and define the next advanced prototypes.

2) *the construction of a small demonstrator of processes, mobile and transparent with easier operating conditions.* It will use an adapted mechanical system for quick and intuitive settings of proportions of produced cold and/or heat and/or electricity. An instrumentation will measure input/output and thermal/ mechanical powers in the system as well as pressure and gas temperatures along the cycle. This demonstrator will provide new exploitable results and prepare the post ANR project. It will highlight the differentiation and economic benefits of the technology, and enable to communicate more broadly among private investors and non-expert publics.

These works and the postdoc's contribution will bring numerous experimental results over multi-scales and will provide necessary PoCs to convince industrials such as Atlanlic or Viessmann to collaborate and support the development of this disruptive technology. It will reinforce the position and influence of Lyon 1 and MSCA as a leading player in energy and ecological transition issues.

[1] Albin E. *Machine thermique régénérative à haute efficacité et procédé associé pour la production intelligente d'énergies*. Inventive part: 100%. UCBL patent FR2508252, submitted on 18/07/25. Discussable on request.

[2] Albin E, Barakat I, Barone F, Malley-Ernewein A, Sanchez T, Xin S. *Intelligent production of cold, heat and power for residential applications*. 18th IHTC, Rio de Janeiro, Brazil, 2-7 August (2026). Available on request.

[3] Barakat I, Albin E, Xin S. *Numerical modeling of a Vuilleumier heat pump and validation using CFD reference data*. 11th ITHMT, Tokyo, Japan, 21-25 July (2025).

[4] Barakat I, Albin E, Xin S. *Simulation numérique du Stirling GPU3 avec gestion améliorée des sauts de section*. 33ème Congrès Français de Thermique (SFT), Chambéry, 3-6 Juin (2025).

Supervision

The successful Marie-Curie Post-doctoral fellow will be supervised by Eric ALBIN.

Eric is associate professor in University Lyon 1 (CETHIL laboratory). He got a mechanical and energy engineering degree in INSA of Toulouse and a PhD degree in turbulent combustion modelling in INSA of Rouen (CORIA lab). He then conducted post-doctoral experimental research in Technische Universität Berlin (HFI lab).

The supervisor was granted by ANR JCJC and he has been coordinating this national project on the intelligent production of energies since 2021. He is the inventor of this innovative technology that is being patented [1]. He has built the mentioned experimental test bench in collaboration with the CETHIL mechanical workshop. He teaches key subjects in the energy department of University Lyon 1: thermodynamics, thermal machines, boilers, cogeneration, heat exchangers… He is recognized as an expert in heat transfer within compressible flows and thermal machines. He has developed in-house numerical codes from 0D/1D models to 3D direct numerical simulations using hpc. At last, he has collaborated with the D-SBT of CEA Grenoble for the modelling of space tube cryocoolers.

Application process

Interested candidates are invited to contact us exclusively by email at "eric.albin@univ-lyon1.fr".

This project receives particular attention from UCBL and the host lab. The candidate is expected to be curious, proactive and proposal force. He must have expertise in the field of heat transfer and/or mechanical/energy engineering and/or instrumentation. He should be versatile and a strong communicator to foster good relationships with manufacturers.

Make sure that you include the reference to this offer in the title of your email. Please attach a CV, a motivation letter, your MSc marks, **as well as a 1 page research proposal**.

Professional grant application support:

Candidates will receive the support of the supervisors, as well as online training from a professional grant application company, and advices from successful applicants, to prepare and submit their application with the CETHIL as a host laboratory, to the next MSCA-PF call for proposals.