LNCMI-Grenoble

SUJET : MASTER 2

Summary

Modelling and sizing based on energy and environmental criteria of a waste heat recovery circuit of the National Laboratory for Intense Magnetic Fields (LNCMI).

Description

The LNCMI is a CNRS laboratory of intense magnetic fields located in the Presqu'île district of Grenoble. This laboratory, whose primary mission is to provide intense magnetic fields to the international community, is also an electro-intensive research instrument: its electromagnets have an electrical power of 30MW and an annual consumption of 10GWh, entirely dissipated in the form of heat.

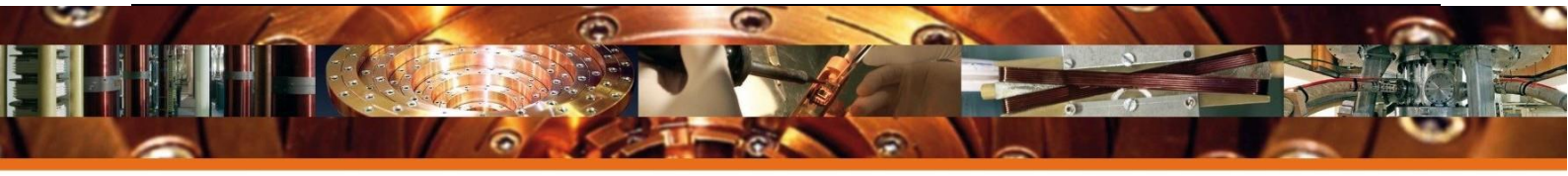
This makes the LNCMI a real energy node between electric and thermal carriers. Work to make its activities and energy management sustainable has been carried out for several years. The LNCMI and the G2ELab are working on the implementation of a pilot circuit of waste heat recovery from the electromagnets to supply heating networks.

The intermittency of heat flows, the differences in temperature and peak power between the cooling circuits of the heat-producing electromagnets and the heating circuits identified for recovery require a detailed modelling of the process. As the buildings are old, a thermo-sensitivity study of heating needs will be carried out in order to optimize the timing of the injection of calories into the circuit.

The student, in conjunction with the field teams, will work on the modelling of the recovery process using the OMEGAlpes software. The first step will be to model the transfer of calories from the LNCMI to the heating circuit of the buildings of the CNRS on the Presqu'île district. These results will be integrated into a second broader stage of development of a multi-energy simulation of the LNCMI by scenarios with a focus on the thermal and electrical flexibility potential.

OMEGAlpes is an open-source tool developed within G2Elab to assist decision-makers in the design and operation of energy systems at the building or district level. It is based on generic energy units (consumption, production, storage, conversion), connected to each other by energy nodes in order to ensure the power balance. It is developed in Python and uses MILP (Mixed Integer Linear Programming) optimization methods.

This internship may give rise to a thesis project: the aim will be to develop a more comprehensive model based on the LNCMI model to adapt it to other European research infrastructures associated with a European project aimed at their decarbonisation (FLEXRICAN). The issues are in particular the integration of large solar parks (several hectares) and/or electricity storage capacity (in the order of ten MWh).



Background and skills expected :

- Good level of English
- General knowledge of energy (electricity, thermal, etc.)
- Technical, economical & environmental assessment
- Computing (Python) - MILP Linear Optimization
- Interpersonal skills (working with a variety of interlocutors)
- Strong interest in the energy transition

Publications linked to the theme

Parts 5.1 & 5.2 of Hodencq, S.; Brugeron, M.; Fitó, J.; Morriet, L.; Delinchant, B.; Wurtz, F. OMEGAlpes, an Open-Source Optimisation Model Generation Tool to Support Energy Stakeholders at District Scale. Energies 2021, 14, 5928. https://doi.org/10.3390/en14185928
Hodencq, S.; Fitó, J.; Debray, F.; Vincent, B.; Ramousse, J.; Delinchant, B.; Wurtz, F. Flexible waste heat management and recovery for an electro-intensive industrial process through Energy/exergy criteria. In Proceedings of the ECOS 2021—The 34th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems, Taormina, Italy, 28 Jun–2 July 2021; Available online: https://hal.archives-ouvertes.fr/hal-03290126

S. Hodencq et al., 'Thermohydraulics of High Field Magnets: from microns to urban community scale', Brest, 2019.

Supervisors:

- Sacha Hodencq – sacha.hodencq@univ-grenoble-alpes.fr
- François Debray - francois.debray@lncmi.cnrs.fr