Research engineer, Post Doc position

Short title : *(Short title)*	*Energy in buildings and eco-design*
Subject : *(Subject)*	Improved modeling of the life cycle of buildings
Keywords *(Key-words)* :	Building energy simulation (BES) - Life cycle assessment (LCA) - Building - District -
Position type : *(Type of contract)*	Contract with fixed duration (12 months), Remuneration according to the level and experience of the candidate
Dates and duration : *(Duration)*	Vacancy from 1st October 2021, duration of twelve months
Level and re-requisites : *(Degrees & Profile)*	This position is aimed at a candidate holding a doctorate, proving experience and skills in the field of life cycle assessment or building energy simulation, in particular in relation to with the missions described below. He (she) will be required to work on the development and improvement of software; programming practice is therefore necessary. A good proficiency in English is essential.
Place of work : *(Rental)*	**Host laboratory** *(Research unit)* : *Center for Energy Efficiency of Systems* (CES) ARMINES - MINES ParisTech https://www.ces.minesparis.psl.eu/Accueil/ The position will be located in Palaiseau and Paris (France). **Research Group** *(Research group)* : ETB (Eco-design and energy in Buildings), https://www.lab-recherche-environnement.org/en/
Working environment : *(Entity overview)*	The Center for Energy Efficiency of Systems (CES) is a joint MINES ParisTech / ARMINES research center, which is one of the main players in French research on energy efficiency and the energy sectors of the future. It is one of the research centers of MINES ParisTech. It has about 60 people including 30 PhD students, spread over two geographical locations: Palaiseau and Paris. ARMINES is the first contractual research association in France, created in 1967 at the initiative of the Ecole des mines de Paris. Its purpose is industry-oriented research.
Mission : *(Missions)*	**Context** The building sector is undergoing a strong transition: reinforcement of performance objectives towards positive energy, reduction of environmental impacts, energy performance guarantee, importance of renovation, extension of the problem to the district scale and links with networks. In response to these requests, the scientific project of the ETB research group of CES combines object-oriented modeling with experimental validation and *in situ* demonstration activities. The COMFIE dynamic thermal simulation tool developed by the ETB team is currently the most used in France by building and teaching professionals. The envelope is modelled with a level of detail similar to that of the reference tools, Energy Plus and TRNSYS. The thermal model is coupled to an aeraulic model (similar to CONTAM-COMIS) and to a lighting calculation (call to Radiance). Object-oriented programming made it possible to integrate different equipments and systems (solar thermal, photovoltaic, heat pumps, ground heat exchangers, etc.). A software publisher, IZUBA Energies, has developed a user-friendly interface based on a graphic modeler. It is linked to a life cycle assessment tool, EQUER, for the evaluation of environmental impacts. This software platform constitutes a working base for research activities concerning technical or architectural innovations. **Missions** • **Research and promotion** The main mission is to explore several avenues for improving the evaluation of the environmental performance of buildings and urban projects, first by a bibliographic study and then possibly by some tests, in order to prepare possible PhD subjects. The subjects listed below correspond to current projects, but the lines of work and priorities may change.

Integration of planetary boundaries in the eco-design tool

The current tool makes it possible to assess environmental impacts and compare them with best practice corresponding to a sample of more than 20,000 buildings. But do best practices perform sufficiently to meet planetary boundaries ensuring "absolute sustainability"? It is a question of studying the feasibility of an absolute reference to complement or replace the current relative benchmark.

Study of the regionalization of impacts

The collaboration carried out with CIRAIG leads to improving the precision of the evaluation of end-point life cycle assessment indicators, by considering regionalized characterization factors. It is a question of updating the database of the EQUER tool according to new knowledge concerning health, biodiversity and resources.

Consideration of overheating in the assessment of health impacts

The current tool integrates impacts on global public health, linked for example to global warming and emissions of toxic substances. But overheating inside buildings also leads to the loss of years of healthy life, an indicator considered in LCA ("DALY"). It is necessary to identify by a literature review an appropriate method to complement the current indicator by taking into account overheating, which will provide a more relevant design assistance.

Application of artificial intelligence to eco-design

The objective is to identify some application possibilities, useful in particular in the upstream design phase. For example, an analysis of data on a large number of concrete and wooden buildings would make it possible to quantify the structural materials in the upstream phase, where all the data necessary for a structural calculation are not available. A questionnaire for data collection will be prepared; it could be sent to partner companies. Another example of an application could be the rapid estimation of consumption or even environmental impacts based on standard scenarios and according to major design choices (for early design phase).

Design optimization (genetic algorithm) and Optimal Control

Optimization is currently being carried out separately in the design phase and then to study a control strategy in the use phase. Integrating control optimization in the design phase could make it possible to improve performance and / or reduce the overall cost over the life cycle of a building.

Contribution to the animation of the research group

The aim is to help supervise interns and / or PhD students and to capitalize on knowledge by integrating models into the software platform.

The work is carried out in conjunction with PhD students and interns working on the themes presented above, and with the software publisher. The aim will thus be to contribute to the dissemination of the results of the work among professionals.

Participation in teaching activities is also possible.

Deadline *(Deadline)* :	The position will remain open until a candidate is selected.
To apply : *(How to apply)*	**Send cover letter and CV by email to :** **Dr Bruno PEUPORTIER** Head of ETB Group, Center for Energy Efficiency of Systems ARMINES - MINES ParisTech 60 Bd St Michel 75272 Paris Cedex 06 Phone. : +33 (0) 1. 40.51.91.51 E-mail: bruno.peuportier @ mines-paristech.fr

Date of updating the profile *(Update)* : 23/07/2021