Publish date March 16th 2021
Ref. 23/2021

Code:
Project: TecnioSpring
Area: Energy Efficiency in Systems, Buildings and Communities Area
Area leader:
Group: Thermal Energy and Building Performance
Group leader: Dr. Jaume SalomTormo

Title: Expressions of Interest for Tecniospring Industry Fellowships in the Thermal Energy and Building Performance Group

Job Description

IREC, in Barcelona, Spain, is interested in receiving Expressions of Interest of potential candidates for the Tecniospring Industry 2021 call (ACCIO, Generalitat de Catalunya).

The **Thermal Energy and Building Performance** Research group at IREC aims to investigate and develop an integrated and systemic approach towards **positive energy buildings and communities**. Globally speaking, the building sector is responsible for 40% of primary energy consumption. Our vision is to investigate in solutions and strategies that accelerates the reduction of greenhouse gas emissions in the building sector through human-centred design, **energy efficiency** measures, **integration and management of energy systems**, particularly **distributed renewable sources** in the built environment as part of urban communities.

In order to develop solutions for reducing energy consumption, we take an approach that is not only technological, but also holistic in that it considers aspects that are crucial for buildings, offices and cities, such as **air quality, indoor environment and socio-economic impacts**, including benefits on occupants' health. Buildings should be considered as nodes of the overall energy system in our society that must contribute to the objective of being climate neutral in 2050, being so important to consider the **integration with the energy infrastructures**: the electrical grid and district heating and cooling networks.

The driving research subject of the Thermal Energy and Building Performance Group is the integrated and systemic approach for Low to Plus Energy Communities, including both analysis at building / urban level and at system level.

The research group is also managing **the Semi-Virtual Energy Integration Laboratory (SEILAB)** which provides advanced expertise to assess the development and integration of renewable energy solutions and innovative thermal and electrical equipment that are designed to improve energy efficiency in buildings and energy systems. The laboratory is provided with cutting-edge technology comprising systems for energy generation, heat and cool storage and state-of-the-art facilities for testing HVAC equipment and the interaction of energy systems with the grid. The laboratory operation is based on a semi-virtual testing approach, which allows for real equipment to be operated as a function of the behaviour of a dynamic virtual model. The laboratory is pioneer in addressing the smart integration of electrical and thermal components and aims to become a leading experimental facility for improving the development of Net Zero Energy Buildings.

We're looking for potential candidates in the following areas:

Positive and flexible energy buildings and communities

From the existing background, the activity of the group is focused on expand the developed methodologies and tools oriented to Net Zero Energy Buildings and energy flexibility from buildings to communities.

Then, the research challenges are connected to develop in-depth knowledge, tools and assessment methodologies for Positive Energy Communities and flexibility energy services that buildings and clusters of buildings may deliver to different types of energy networks. Technical challenges are related to the development of new simulation modules to be integrated in existing or new urban simulation tools to assess the benefits of concepts and operational strategies in clusters of buildings. Identified challenges that are the core work of the group are the following:

- development and computation of Key Performance Indicators (KPIs) at district level;
- control and management strategies at building and district level;
- simultaneous simulation of the short-term interaction with energy grids;
- reduced order building models for integration in simulation tools, model predictive control strategies
- stochastic human behaviour modelling
- co-benefits analysis for smart retrofitting and construction of buildings
- business models for new energy services and large-scale retrofitting actions

Inhabitants' health impact fur to Energy Efficiency improvement in low-income housing

The research proposal wants to demonstrate quantitatively which is the positive impact of energy retrofit of houses on the inhabitants' health.

The main objective of the project is to evaluate the effect of energy efficiency upgrades to MED households in terms of thermal comfort, well-being and health of inhabitants, energy consumption and economic impact. The study will be conducted in a vulnerable urban area with buildings from the main typology of Spanish building stock, providing scientific evidence for most of the low-income households of the country. The research proposal wants to cover the following specific objectives:

- To evaluate the impact of the energy efficiency improvement on thermal comfort and well-being of users, and the energy consumption of the housing
- To evaluate the impact of energy efficiency improvement on inhabitants' health, highlighting the following issues:
- To analyse both the cold and warm temperature effect, as most of the previous works are only focused on the effect of indoor cold temperatures. However, in MED countries and in a climate emergency context, it is also important to investigate the impact of indoor warm temperatures in occupant's health.
- To estimate when the health benefits of the intervention become evident after the energy renovation of households. Most of the previous works concluded that the health changes occur in a long term and are not visible in the framework of the studies.
- To consider the inequality axes: age, social class, socioeconomic status, ethnicity and gender.

- To estimate the potential economic savings for the Spanish healthcare system due to the energy efficiency improvements of housing, using the new evidences obtained by the project.
- To synthetize the conclusions and the policy implication of the broad impact of the energy efficiency at national level.

Low grade energy sources for low energy cities.

The main objective of the research is to evaluate the integration concepts for low exergy heat sources, waste heat recovery, and prosumer building for operating 4rth and 5th generation district heating networks as energy hubs for low energy cities. The main challenges identified are:

- To identify, locate, quantify, and integrate low-grade urban heat source such as sewage waters, underground tunnels, etc…
- To develop technical concepts and business models concepts for promoting industrial and DC waste heat recovery.
- To integrate prosumer buildings for flexible grid management.
- To identify urban planning conditions that favourable deployment of energy hubs.
- To manage and control energy hubs with multiple energy sources.
- To promote district heating networks in countries dominated by individual heating and cooling systems.
- To integrate thermal and electrical networks.

We are looking for excellent and highly motivated candidates with a MSc degree in Mechanical / Electrical Engineering and/or Energy systems, with some experience in HVAC, thermal renewable systems and generally speaking energy systems in buildings and/or cities. Knowledge in renewable energy technologies and experience in computational energy systems and simulation tools (especially TRNSYS) is highly valuable. In addition, it is necessary to have some experience in programming tools and/or packages as Python, Matlab, C++ or R.

We are looking for a methodical and rigorous person with a scientific spirit and results oriented. Teamwork and communication and management skills will also be a requirement. Mastery of English on all levels will be essential. Knowledge of other languages will be desirable.

Benefits

The annual budget includes funding for salary plus research expenses. The salary will be in accordance with the Tecniospring Industry call.

Fellows will be based at the IREC headquarters in Barcelona.

Elegibility criteria:

According to the Tecniospring Industry 2021 call, the fellows must:

- Hold a PhD plus 2 years of additional postdoctoral full time research experience (or at least 6 years of full time research experience).
- Mobility rule:

- TS Incoming: Not have resided or carried out their main activity (work, studies, etc.) in Spain for more than 12 months in the last three years.
- TS Outgoing: Not have resided or carried out their main activity (work, studies, etc.) in Spain for more than 12 months in the last three years.

Application:

Researchers willing to apply should check that they meet the eligibility requirements and send the expression of interest, including:

- Their CV
- A motivation letter
- A summary of their research proposal

Expressions of interest should be sent by email directly to the KTT Office (ktt@irec.cat) indicating "Call for Expressions of Interest for Tecniospring Industry Fellowship in the Thermal Energy and Building Performance Group" in the subject.

Nr of positions available: 3

Research Fields

- ✓ Positive and flexible energy buildings and communities
- ✓ Inhabitants' health impact fur to Energy Efficiency improvement in low-income housing
- ✓ Low grade energy sources for low energy cities

Researcher Profiles

Recognised Researcher (R2)

Established Researcher (R3)

Application Deadline: 15/05/2021