PhD SCHOLARSHIP APPLICATION

Division / Business Area: Construction / Retrofitting and Integrated Urban Regeneration

Building / Province: Derio / Bizkaia

SCHOLARSHIP DESCRIPTION

Title: Energy analysis of high efficiency sustainable buildings and districts through physical modelling and simulation.

Brief description:

Applied research on the integration of high efficiency and renewable energy technologies in buildings and districts, for which the development of physical models of buildings and their main systems (generation, distribution, storage, consumption), dynamic co-simulation and analysis of synergies between buildings and distributed generation elements at district scale and the configuration of nearly zero energy consumption buildings and districts is required.

Detailed description:

In recent years, the Construction Division has been advancing in the research of high efficiency technological solutions and their use for energy retrofitting and urban regeneration, from the innovative component scale (materials, construction systems ...), nearly zero energy consumption buildings (nZEB), nearly zero energy districts and the configuration of smart and sustainable cities. Along this line, our multidisciplinary technical team (engineers, architects, physicists, ...) has led and/or participated in major European projects in the field of energy retrofitting in search of nZEB (A2PBEER, BRICKER), optimised modelling of buildings and districts, learning about the user through IoT and the energy and environmental retrofitting of urban environments (SmartEnCity, FASUDIR).

In smart cities, buildings cannot be considered to be simple isolated consumer elements, but rather players with a dual role of energy consumers and generators in the urban environment. Both the design of new smart neighbourhoods and the scale retrofitting of districts will require the optimised management of energy resources, bearing in mind the interaction between buildings. In this context, it is necessary to go beyond the usual methods of energy simulation in the construction sector (in which isolated buildings are modelled with standard parametric conditions) and address multi-physical simulation of the set of buildings-district in a holistic way.

The main line of research will be the dynamic simulation of complex buildings-district models for the optimised design and operation of *nearly-zero* urban environments (buildings, common infrastructures, urban space). The doctorate student needs to undertake the following tasks during his/her training and research:

• Study and command of physical simulation techniques for buildings through graphic modelling environments, such as DesignBuilder or OpenStudio and programming in EnergyPlus.
• Development of user behaviour models in their interaction with the constructed environment.
• Development of new building and district scale DER components through EnergyPlus EMS and composing Modelica libraries.
• Dynamic and parametric modification of the code of models.
• Co-simulation in real time and in dual time between building and district models based on the latest FMU platforms and methods.
• Configuration and validation of complex district models for real and/or virtual case studies based on the libraries of models developed, which allow for the optimisation of control strategies and decision-making (DSS).

REQUIREMENTS

Degree and specialisation:

University Official Master's Degree in Engineering and/or Architecture. Degree in Engineering, Physics or Architecture. In the field of Thermal Engineering, Sustainable Construction, Energy Efficiency and/or Renewable Energies.

Languages:

Advanced level of English.

IT skills: Knowledge of programming, data processing and multi-physical simulation.

More specifically, programming languages and data processing tools (Matlab, Simulink, R, Python…) and physical and energy simulation software (EnergyPlus, Modelica, DesignBuilder, EES…) will be useful.

The following will be a plus:

Previous experience in theoretical and experimental analysis of the energy performance of buildings and urban environments and their main HVAC systems.

Further information and applications: http://bit.ly/2qBR0UY