

## Thermal rehabilitation of buildings using solar passive techniques

► **Sara Brito Coimbra, Faculty of Sciences and Technology of NOVA University**

More than 2/3 of the Portuguese residential building stock was built prior to the first thermal building code (RCCTE) in 1990 and is characterized by buildings with poor quality of the envelope, which considerable influence on both, indoor thermal comfort and thermal performance of the building. This is the reason why in Portugal are recorded one of the highest excess winter morbidity rates at European level [1].

Is there a need in Portugal to find adequate strategies to improve the energy performance of the building without sacrificing the indoor thermal comfort. Once Portugal has a great solar potential, one of the solutions might be the use of transparent skin technologies, which is a passive solar technique.

### OBJETIVES

- Design a retrofit scheme of a transparent skin used in the exterior envelope to increase indirect-solar gains during heating season;
- Quantify and analyze the influence of transparent skin technologies on the thermal-energetic performance of a retrofit building;
- Analyze if it is economic advantageous to thermal rehabilitate Portuguese buildings with transparent skin technologies.

### RESEARCH QUESTIONS

- To what extent can a transparent skin increase the indirect-solar gain in retrofit projects?
- To what extent can the mentioned technology reduce heat losses?
- How the proposed retrofit scheme performs during the heating season and during the cooling season?
- Is the proposed retrofit scheme suitable for any Portuguese climate zone?
- Is the proposed retrofit scheme sustainable? Why?

The previous questions are interesting study topics, once despite of the high potential for utilising solar energy in buildings located in the Mediterranean climate, the passive solar technologies are largely unexplored in retrofitting the residential buildings in Portugal [2].

### METODOLOGY

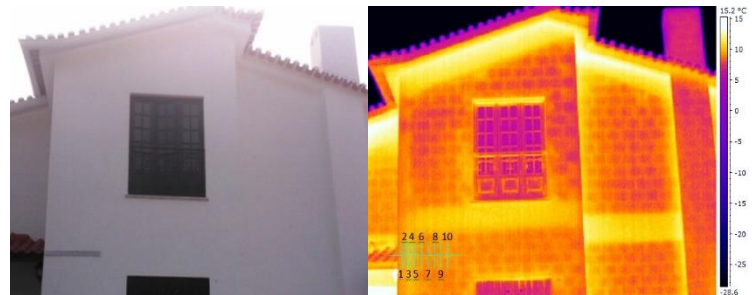
- Develop a numerical model to analyze the thermal performance of the proposed retrofit scheme;
- Build a prototype and monitor important parameters (e.g. superficial internal temperature) to analyze and validate the model.

It is important to carefully analyze the performance of the proposed retrofit scheme during the cooling season to prevent overheating. If it needed, should be mention other passive techniques to work along the proposed one to prevent the phenomenon.

### RESULTS/RESEARCH IMPACT

With this PhD work is expected to develop the existing knowledge about transparent skin technologies in Mediterranean climates, especially in Portugal. Most of all, it is expected to design strategies which help improve the indoor thermal comfort of Portuguese residential buildings.

► **Supervisor:** Daniel Aelenei (FCT/UNL)



► **Fig. 1:** Façade of a single and its thermographic image [3].



► **Fig. 2:** Façade of a single and its thermographic image [3].

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