

Fiche Projet CNEREE

I. Descriptif du projet

1. Intitulé du projet- Référence- Programme

- **Dynamic modelling and monitoring of passive systems for air heating and cooling for buildings**
- Acronym: PasSyB
- Source de financement: Programme Maroc-Allemand de Recherche Scientifique
- Programme: **PMARS2015-2022**
- Durée du projet: 2016-2019

2. Budget Global

860 500,00 MAD

3. Résumé du projet

Energy efficiency is one of the main goals of national energy strategies among the world. Morocco recently developed a National Energy Strategy, which particularly aims to introduce energy efficiency in buildings.

Indeed the residential sector accounts for more than 25% of the final energy consumption in both European and Mediterranean countries and this consumption is bound to increase and hence the accompanying carbon dioxide emissions. The use of conventional air-conditioning systems has a big influence on the electricity peak in summer. To achieve the goal of the best environmental-thermal comfort within a building having lowered conventional energy consumption during the summer period, it is advisable to make use of passive or low-energy cooling strategies, including the reduction of the cooling load of the buildings.

In Morocco, the operating power cost of air conditioning systems for buildings accounts for more than 40% of the total power bill. Furthermore, the impact of air conditioners usage on electricity demand is an important issue as peak electricity load increases continuously, forcing the National Electricity Authority (ONEE, www.onee.org.ma) to build additional plants. In parallel, serious environmental problems are associated with the use of air conditioning.

In the Moroccan traditional way of life, people developed empirical solutions (architectural, but also behavioral) to reach an acceptable level of thermal comfort. However the rapid growth of income induces higher comfort requirements, which is mostly achieved in modern buildings through the use of electric air conditioning equipment. This leads to a significant increase in energy consumption and consequently also in greenhouse gas emission. However, it is often possible to fulfill thermal comfort requirements at low energy cost and reduce CO₂ emissions, taking advantage of the particular climate features by an appropriate design of the building accompanied by low energy ventilation strategies.

The Moroccan Agency for the Energy Efficiency (ADEREE, www.aderee.ma), recently developed a building energy code which includes the prescriptive thermal regulations for different kinds of buildings and different climate zones (RTCM, www.aderee.ma).

The German team has experience in the field of energy efficient buildings by handling a variety of research projects concerning this topic. The spectrum ranges from concepts for the energetic renovation of the building envelope, over studies for the use of Sterling engines and fuel cells in buildings to innovative concepts for building tempering (heating and cooling with low energy).

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4. Objectif général

The main goal of the project is the use of passive systems for heating/cooling for buildings in hot climates and modeling and monitoring of such systems. Especially the use of an earth-to-air-heat-exchanger (EAHX) will be examined in greater detail. The EAHX has a significant potential for increasing the buildings' comfort while decreasing its energy demand. A dynamic simulation of the EAHX is planned (software TRNSYS), moreover the EAHX should be modeled in a CFD software and parallel an existing EAHX in Morocco will be monitored.

As a second part, low energy heating and cooling application (developed from the German partner in past and current projects) can be investigated based on simulations for southern climate.

An important outcome of the project (additionally to several publications and workshops) would be the development of a network to initiate new projects and ideas.

5. Objectifs spécifiques

- Study the effect of some passive techniques and low energy systems on the cooling and heating loads of a residential building in Marrakech, by means of:
 - ✓ Dynamic modeling
 - ✓ Monitoring
- Further enhancement of an existing numerical tool for the modeling of the connection of the Earth-To-Air
- Heat Exchanger to a building.
- Develop some rules for energy efficient buildings in Marrakech and Morocco, respectively.

6. Principales activités prévues ou réalisées

The studies will be conducted on an existing building, so called AMYS which integrate many passive/hybrid systems for air cooling and heating. One of the systems connected to AMYS house is the Earth-to-Air Heat Exchanger –EAHX. A transient multi-zone thermal simulation model will be applied in the present research for modeling the building.

As the objective of this project is to evaluate the performances of the passive techniques integrated into the building, especially the Earth-to-Air Heat Exchanger –EAHX, simulations will be conducted on several configurations of the building with comparison to a 'reference house' built as usual in Marrakech.

II. Partenaires du projet

▪ Coordination du projet

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▪ Partenaire académiques:

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- b. The National Centre for Studies and Research on Water and Energy (CNEREE)