POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture
Honors theses

Designing in the desert. A bioclimatic approach at the urban scale
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This Master thesis was developed in an exchange project between the Politecnico di Torino, and the École Polytechnique Fédérale de Lausanne. The project was co-directed by Prof Jean- Louis Scartezzini and Dr Jérôme Kaempf of the Solar Energy and Building Physics Laboratory.

The increase of the world's population leads to an urgent need of radical measures to diminish the energy footprint of humanity. The building sector deserves special attention being one of the major energy consumers, especially when considering space conditioning in extreme climates.

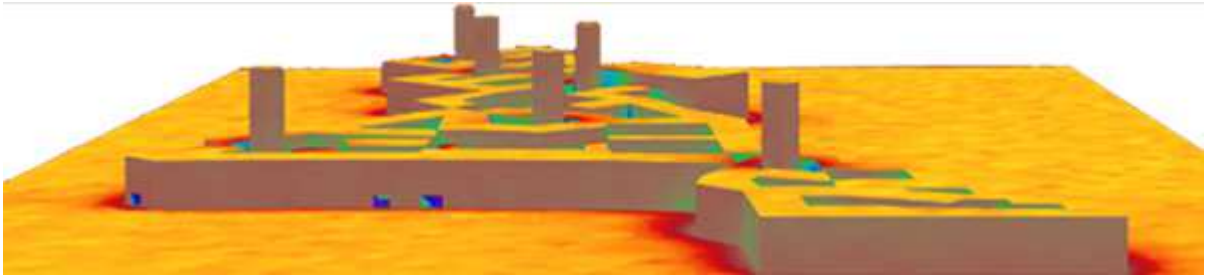
In the case of subtropical-arid regions, optimizing the performance of air-conditioned shelters may lead to a drastic reduction in the electrical consumption. With the help of energy modeling tools at the concept stage, one of the primary objectives for a new architectural and urban project is to improve the environmental sustainability.

This study considers the realization of an optimal Masterplan in energy terms for the new EPFL Research Centre in Ras Al Khaimah, UAE. The work was developed reuniting two aspects: the archetype of Arab architecture and the bioclimatic analysis. The study of the Arab architecture, from urban scale to the building level, defines the architectural archetype, as form and materials, history and human relationship. It was revisited from the bioclimatic point of view, adding a solid scientific base to the observations.

Render of the Masterplan. East view

A hypothetical Masterplan conceptually connected with the Arab Medina, as architectonic symbol of the Arab architecture and as bioclimatic model, was defined. Several analyses with CitySim, an Urban Energy Modelling tool, were made to optimize the urban form. The courtyard house was defined as the best bioclimatic building. The best building orientation and glazing ratios were defined to guarantee passive solar gains during the winter months, and to reduce overheating risks during the very hot summer months.

The hypothetical Masterplan respects the Minergie standards for tropical climates; furthermore it ensures a good energy performance of the campus using renewable energy sources to guarantee a limited carbon footprint.



Solar analyze of the entire Masterplan. South view

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