



POLITECNICO  
DI TORINO

# Honors thesis

---

COURSE OF MASTER'S DEGREE  
IN ARCHITECTURE CONSTRUCTION CITY

*Abstract*

**BiosPHera 2.0**

**energy efficiency and psychophysical well - being**

*Tutor*

Guido Callegari

*by*

Maria Niccoli  
Karen Rizza

July 2017

The project BiosPHera 2.0 is part of a joint venture by Aktivhaus, the Department of Architecture and Design of the Politecnico di Torino, the Université de la Vallée d'Aoste, and institutions and agencies that monitor energy standards and production quality, such as ZEPHIR - Passivhaus Italia, Minergie and PEFC for the sustainable management of the forests.

The travelling module BiosPHera 2.0 is an experimental research project designed to analyse the level of psychophysical well-being of users in an energy-efficient residential environment, thanks to the cooperation with the Affective Ecology Laboratory of the University of Aosta Valley and the certification agencies for passive house

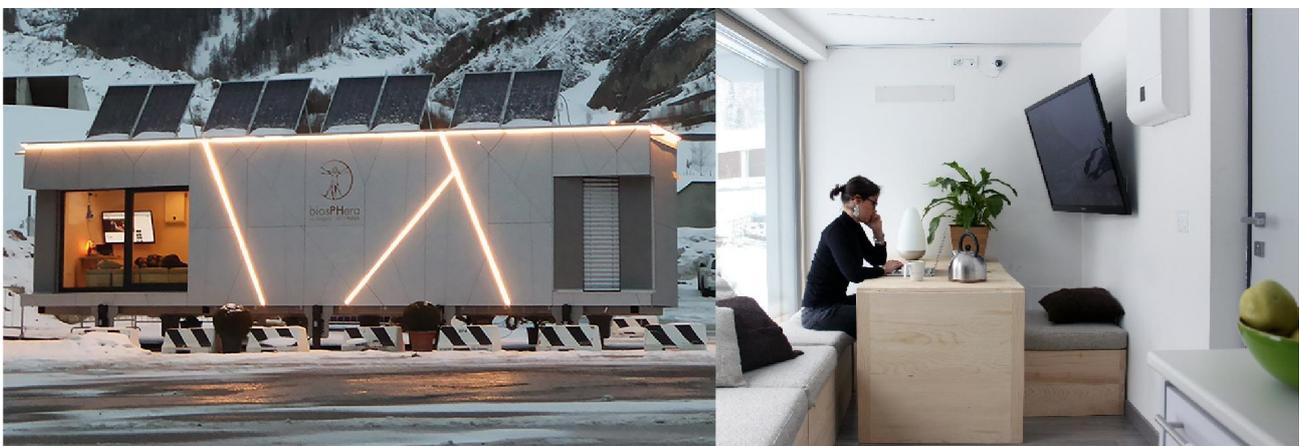
The innovation of the project lies in the study of the interaction between physical and energetic parameters with the cognitive and sensorial aspects.

For the first time, there has been a complex work of scientific, technological and environmental research that allowed the study of human well-being in a domestic environment. Additionally, it defines the connection between building envelope technologies, plant engineering systems, architectural appearance, environmental and the psychophysical behavior of the human body.

The aim of the thesis has been reached by the realization of a 12x3x3m travelling module 26 sq. m residential space called BiosPHera 2.0, that represents the ideal prosecution of a previous experience developed by the Zephir Passivhaus Italia Institute: the BiosPHera 1.0. The project lasted for 1 year and 3 months, from September 26, 2015 when the "Thinking outside the box" workshop started in Torino, until January 27, 2017 when the experimental phase was concluded alongside the Klimahouse Fai in Bolzano.

Over a full year the module participated to an international roadshow through several cities such as Courmayeur, Milano, Torino and Locarno, in which BiosPHera 2.0 and the 32 guests that lived inside of it have been submitted to continuous thermal and environmental stress tests.

Using innovative monitoring devices, more than 25 parameters related to the behavior of the building envelope and related to the psychophysical well-being indicators of the guests have been collected and studied.



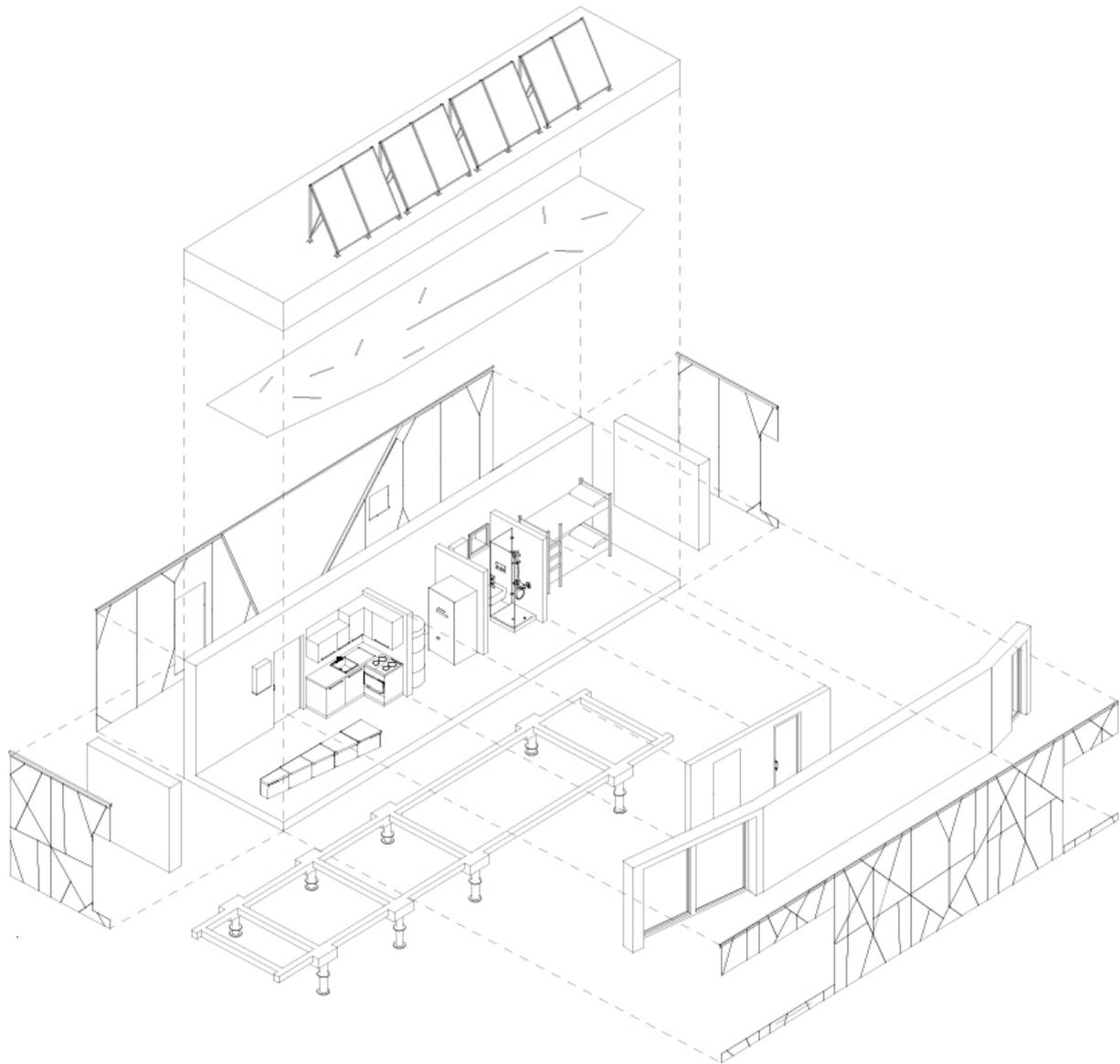
The main stages of the project in which we were closely involved: Development of the architectural concept design, the building construction, the experimental phase during the module roadshow and the analysis of the data collected

In relation with the BiosPHera 2.0 project, the objective of our thesis was twofold.

On one hand, we were trying to test ourselves, using the *learning by doing* method, as architecture students in the design of a residential module following all the phases: from design to experimentation.

On the other hand, when the data collection period ended, we analyzed and compared the parameters related to the psychophysical aspects with the sensorial-cognitive ones, with the intent of storing them in a system.

Therefore, in our thesis, we present the theoretical background and motives for the development of the project, the phases of the project stressing the innovation of our contribution, the description of the project, and finally the analyses of the data collected during the experimentation together with our personal conclusions.



---

For further information please contact:

Maria Niccoli [marianiccoli@hotmail.it](mailto:marianiccoli@hotmail.it), Karen Rizza [karenrizza85@tiscali.it](mailto:karenrizza85@tiscali.it)