



sd europe
SOLAR DECATHLON

Hochschule Rosenheim
University of Applied Sciences



SOLAR DECATHLON EUROPE 2010

TEAM IKAROS

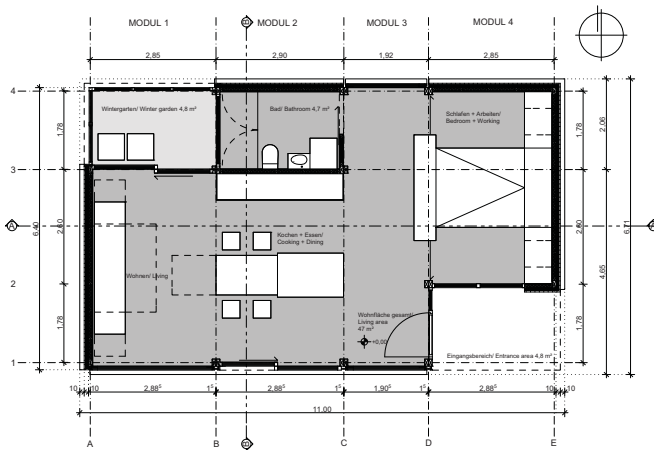
THE HOUSE

The architectural design concept of the competition house is based on the modern interpretation of a natural function.

This means that we want to offer a home to the person who will live in our house, which in its rough structure will be similarly constructed as a natural shell, preserving and protecting the interior space. Man is directly connected to nature, with his needs resulting from instincts, which have developed over thousands of years. Behavior patterns seen in nature can be directly applied to man. The living environment of man – i.e. the exterior influences – have changed. But although man adapts to situational conditions, he does not lose his natural basic needs of shelter, retreat and warmth.

We take into account the basic needs of man in urban structures and create a self-determined point of retreat for him. The building envelope of our concept is similar to a natural structure that protects the core.

The competition prototype envelops the four modules constituting the building. We will prefabricate the modules in Rosenheim and assemble them on-site. One module contains the function of the sleeping and working area, while another forms a hall area, which is enlarging the room, and another the cooking and dining area as well as the bathroom unit and the living area.



THE INTERIOR

The architectural concept is also perceivable in the interior space. Each of the four modules is characterized by an individual usability or an individual piece of furniture. The space is visually connected through an integrated, plain design.

In the center of the room a kitchen block is located. It accommodates a sink, a hot plate, a dishwasher and various drawers, which offer storage space. In addition, a dining table, which is made of sheets and offers space for 4 to 8 people, can be extended at the left front side via a telescopic substructure.

The living space located at the west side contains a ceiling-high wardrobe element, which also offers sitting accommodation for several people thanks to a big alcove. The upholstered seat surface area of the alcove can be extended forward electrically. In this way, an additional sleeping place for guests is created.

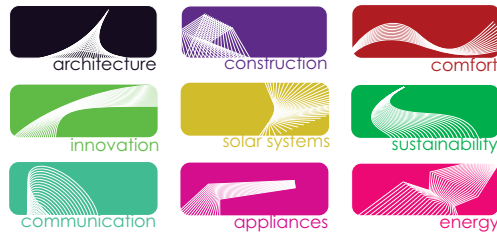
The bedroom offers the occupant numerous possible uses, like for example sleeping in a 2m x 1.8m bed. As seen from the bed, the bedroom consists of two stationary exterior walls, a glass facade located at the south side and a wall with an integrated screen, which forms a partitioning to the kitchen. The bed can be electrically extended from and collapsed into the wardrobe, which is located behind it. Moreover, the wall which is partitioned to the side of the kitchen offers the possibility of mechanically lifting the screen and of folding out an approximately 2m wide working surface. For festivities, the mobile wardrobe can be electronically moved inside the stationary wardrobe element, so that the living surface area is considerably enlarged.

Apart from the shower, the sink (which is mounted on a thin, freely overhanging wash-stand) and a WC, the bathroom unit also contains a wardrobe element, that includes storage space and also contains the washer and the dryer. The shower is delimited by clear ESG security glass, the fixtures are recessed into alcove and ceiling, respectively.



THE MOTIVATION

For the students, the participation in the Solar Decathlon is especially appealing because the developed concepts and ideas will actually be built, and not remain merely theoretical models. In addition to that, this competition is an excellent platform for establishing contacts to the industry and for extending one's interdisciplinary knowledge, which can be of great value in the future working life - not to mention that through the work in a big team, which consists of constructors, architects, physicist, domestic engineers etc., so-called „soft skills“ are developed and cultivated. Moreover, in the course of time it became apparent that work in such a big project also improves the cooperation within the university and creates synergy effects, that are of great value to the university. Naturally, all participants are endeavoring to get a good placement in Madrid. The university as a whole expects to get a certain degree of national and international attention through this contest, which will be even increased through numerous trade-fair appearances. In this context, the university's contribution to the Solar Decathlon serves as an excellent reference object.





sd europe
SOLAR DECATHLON

Hochschule Rosenheim
University of Applied Sciences



SOLAR DECATHLON EUROPE 2010

TEAM IKAROS

THE BASIC ENERGY CONCEPT

For reducing the energy requirements, airtight components with highly effective thermal insulation for the thermal envelope and a regulated ventilation with heat recovery are deployed. For heating and cooling of the building a reversible compression heat pump is planned. A cooling ceiling is used as a back-panel system. Through regulated ventilation an optimal balance between room temperature and relative air moisture is achieved.

The building geometry will be optimized with view to energy gain, and the envelope will be equipped with various energy gaining systems. Besides the necessary evacuated tube collectors, highly efficient, monocrystalline PV cells are used on the roof. The building envelope comprises terraced setbacks, so that not only the living comfort is increased, but also a minimization of solar loads is effected.

The concept of radiation cooling is realized by wetting the roof surface with rain water. By using this principle, a radiation exchange takes place between water and night sky, thus facilitating natural cooling. To avoid peaks in demand in our wood skeleton frame, we will use actively ventilated PCM, which will be integrated in floors and walls.

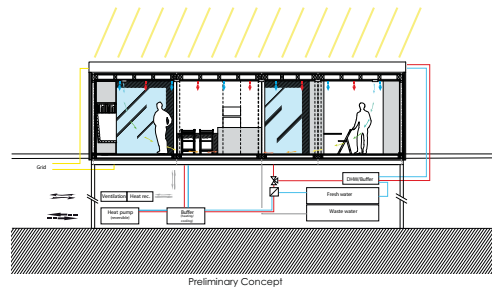
Our aim is to compensate the loads occurring in summer through the two passive measures, radiation cooling and PCM, and to cover the low heating requirement in the winter months through solar gains from the „open“ south facade. In this way, the requirement will be kept so low, that it can already be covered by using a photovoltaics surface of less than 4 m².



THE SYSTEMS

The photovoltaics system of our house will be mounted on a substructure. This substructure will have a tilt of 3° to the roof cladding. This tilt serves for radiation cooling. The individual PV modules and possibly also 2 solar thermics modules will be mounted on this substructure. Thus, the position of the PV modules is almost horizontal. In the simulation, the PV modules have been evaluated to be back-ventilated. However, due to the mounting and the distance to the roof surface, an air stream can be directed through below the modules when there is a northwestern wind. However, because of reasons of plausibility this has not been taken into consideration.

Solar thermics is the conversion of solar energy into usable thermal energy. The use of solar energy for heating of a medium has the following purpose: for one thing, it contributes to the heating of water which is required for showering, cooking, doing dishes etc., and for another thing, this contributes to heating during winter. According to the calculation, the necessary surface of solar collectors will come to approximately 6 m². In our case, we have the choice between the evacuated tube collector and the flat-plate collector.



THE SUSTAINABILITY

The sustainability concept of our house aims at protecting the environment, saving natural resources, protecting health as well as economic and cultural values. The following criteria will be evaluated: ecologic, economic, sociocultural and functional quality, as well as the quality of the technologies and planning execution.

All climate factors regarding comfort are mainly influenced by passive measures. An intelligent ventilation, an optically appealing sun protection and the radiation cooling provide comfortable living conditions with minimal energy consumption, and without the use of toxic substances. Through the construction, which primarily consists of renewable natural resources, an agreeable indoor climate is created. Moreover, it can be renaturated with nearly unmixed sortage, which is health-promoting and environmentally friendly.

Through the modular structure of the house, an extremely high degree of prefabrication can be achieved, which is not only efficient and cost effective, but also guarantees technical quality. Two standard trucks are sufficient in order to transport the completely built out envelope in a cost effective and resource-saving way. Another effect of the high degree of prefabrication is a short construction time.

User-friendly building automation facilities provide true living comfort and increase the building's functionality. A detailed and integral planning guarantees a high degree of quality in the projecting process.

