



# ENVIRONMENTAL SYSTEMS I

ASSIGNMENT 6: Building Heat Transfer Analysis

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Project Name: **IKAROS House**

Location: Madrid, Spain

Climate:

Madrid and its metropolitan area has a hot-summer Mediterranean climate with continental influences, with cool winters and hot summers.

The summers in Madrid have hot and sunny days with temperatures around 31-32 °C (87.8-89.6 °F) but can be 35-40 °C (95-104 °F) on some days. Overnight temperatures average around 19 °C.

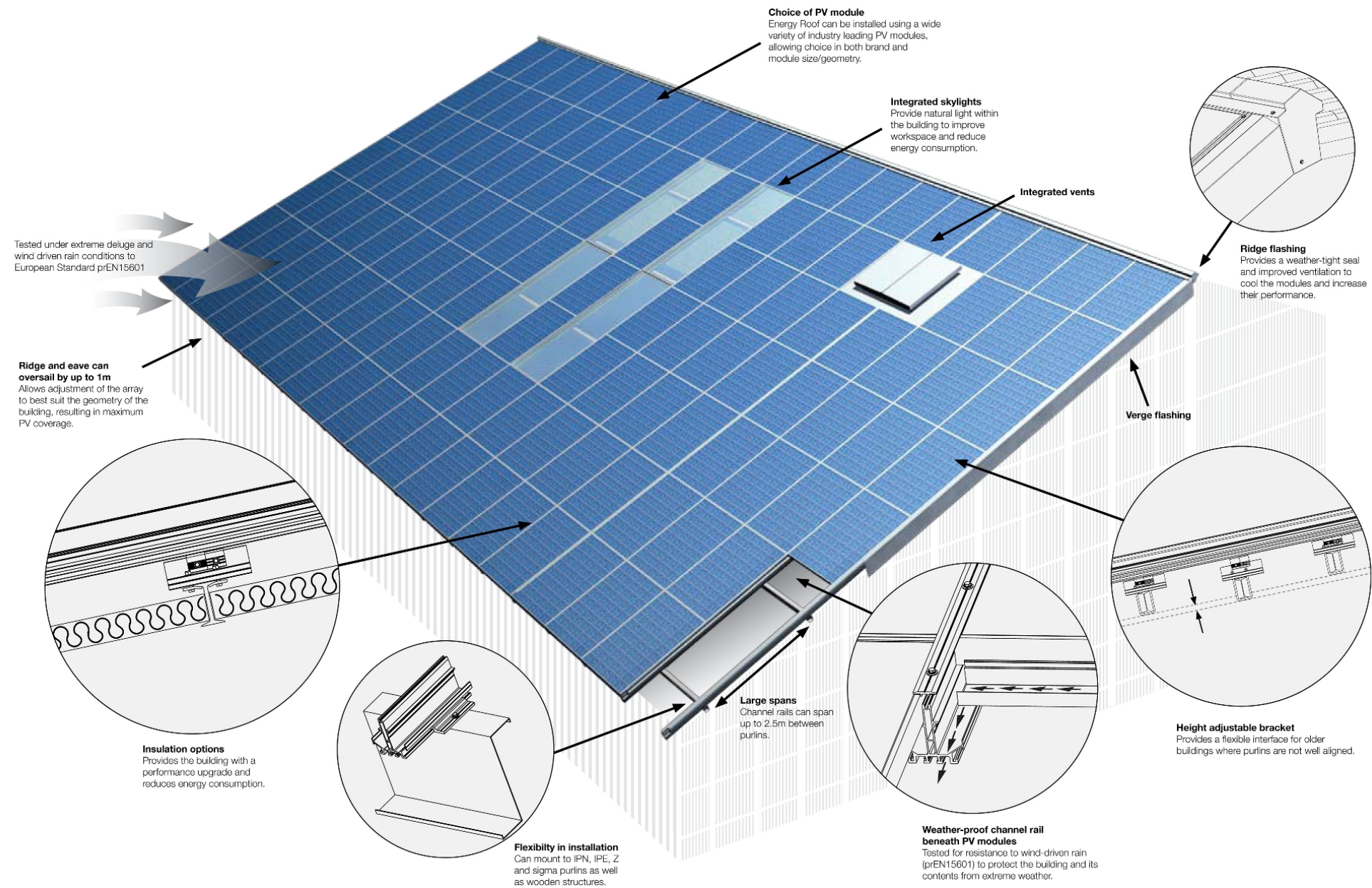
Introduction:

The IKAROS House is built as a competition project for the European Solar Decathlon by the University of Applied Sciences in Rosenheim, Germany. It is a house designed for a family of four.

Design Strategies:

It features a system of sun-shading panels wrapping around the building, which serves to shade the home so that it requires less energy to cool in summer months, and excess energy from the home's systems is used to keep the home warm in the winter. It also features in the use of a variety of green technology such as solar panels, vacuum insulation panels, efficient mechanical systems and natural ventilation. It has high energy efficiency and a large solar system capable of generating more than four times the power needed for the home.

# Design Strategy - Solar Panel



The use of solar panels is meant to absorb energy or radiation from the sun, it is an intentional act of collecting solar energy from the sun, which could be converted to other forms of energy for example electricity, which can be used as sources for electronic devices in the house. By converting solar energy gained from the sun to other forms, the solar panels helps to increase the energy efficiency in the house.



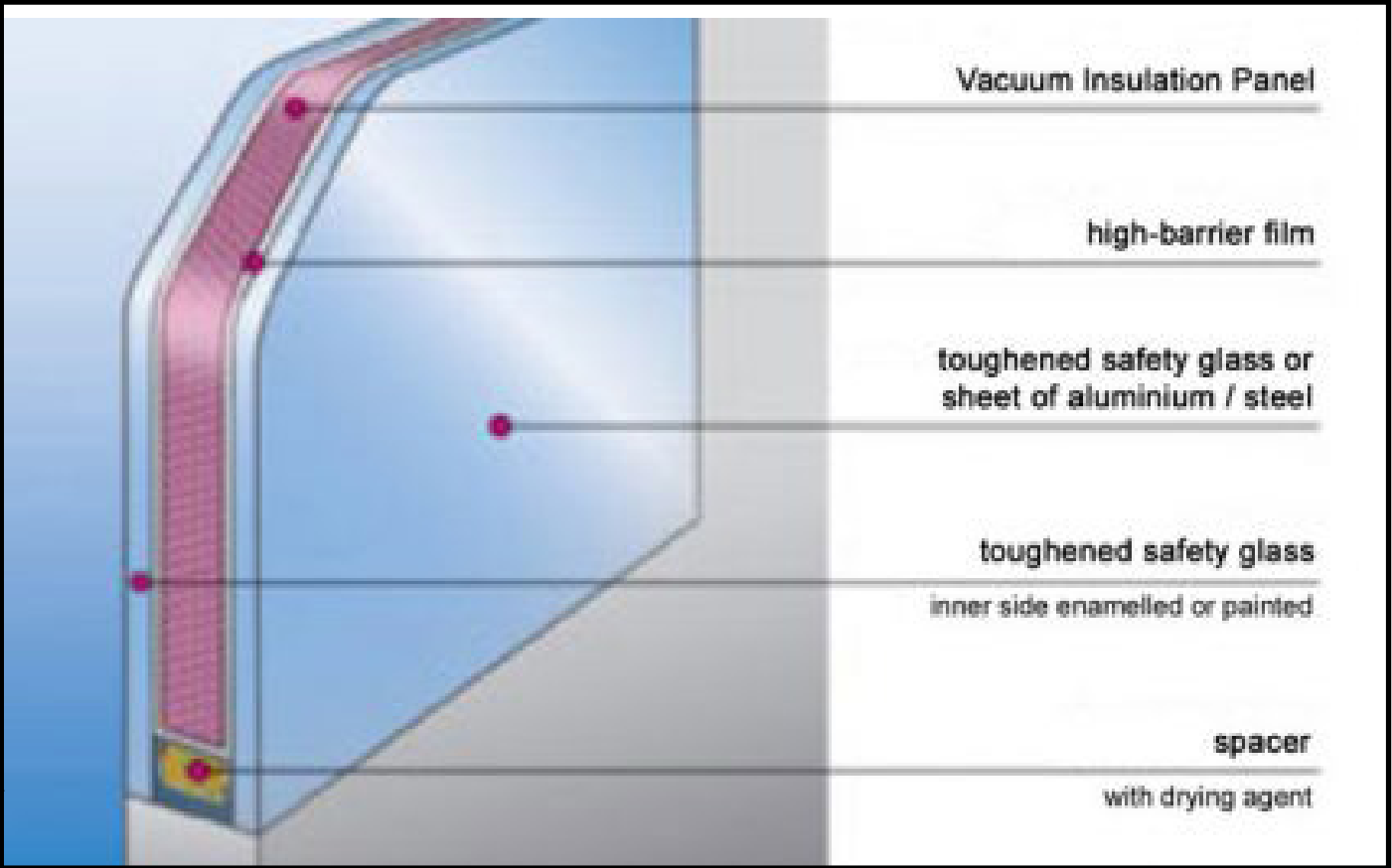




The exterior sun-shading panels block some of the sun radiation. During hot summer days, the sun-shading panels prevent sun radiation from entering the space which may increase the interior temperature. By blocking radiation, it saves the energy that is intended to cool down the interior space. Meanwhile, the sun-shading device is open to the air, so it allows wind to pass through and allows the air exchange between inside and outside, thus increase the natural ventilation.



Design Strategy - Vacuum Insulation Panels



The vacuum insulation panels prevent the heat transfer from the interior and the exterior of the house by reducing the convection of hot and cold air to its minimum. Therefore, the indoor temperature is less likely affected by the outdoor temperature. In addition, the small floor area of the house helps to keep the heat.

1) Add water fountain in front of the house and operater that in hot summer days. There are two reasons behind this design strategy. First is that the evaporation of water can consume heat from adjacent environment, thus lowers the exterior temperature around the house. The second reason is that it creates convection of the air, since once the temperature is lowered around the fountain, the other air whose temperature is higher will conduct convection with low temperature air, thus creating convection and will increase the ventilation of the building as well.

2) Make the flat roof into diagonal ones to increase surface area of the roof with solar panels. By increasing the surface area of the roof, it increase the amount of radiation the solar panels get from the sun, therefore increase the energy efficiency.

3) Add windows that are facing each other, to first increase the sun radiation during winter time, and at same time increase the chances of cross ventilation to get a good air exchange between the inside and the outside of the building.



Reference:

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