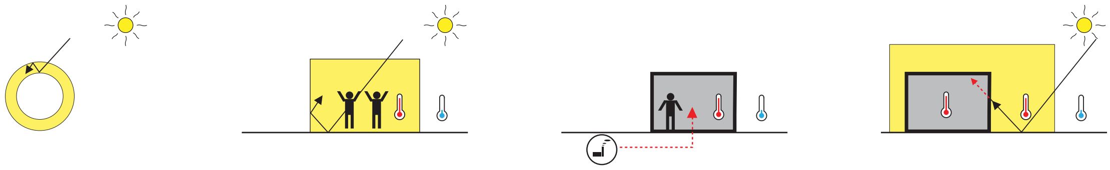
UNIT

unitark.se

CASE

GLASS HOUSE TRÄSLÖVSLÄGE



In Träslövsläge just south of Varberg on the Swedish west coast Karin and Sven-Olav acquired a parcel of farmland. This property is located along an old village street with a vast open field behind. In addition to the old traditional main building a large barn and a smaller cottage are situated on the plot. To the south there is an extensive orchard with a rich variety of trees. The buildings are placed in parallel on both sides of a courtyard whereas the traditional farm typology of this rural area dictates buildings to be placed on three sides of the yard. Since the main building was small and in poor condition the growing family needed more space. In addition to this a large glassed entrance was also required.

The solution was to frame the courtyard with a 250m^2 greenhouse and place a smaller 70m^2 building inside. In this way the view of the orchard was saved; you see it through the glass when you enter the courtyard from the street. The total building cost equalled that of a 100m^2 house; the difference in size of the indoor space corresponds to a normal living room. So instead of 30m^2 living room in a conventional house they got 150m^2 of living space in the glazed structure. The greenhouse was built out of standard components and erected by a separate contractor.

The plan was reorganized so that the existing main building houses the bedrooms in order to avoid complicated technical installations in an old building. Another reason for this was the ability to lower the room temperature in these spaces to reduce heat loss from the poorly insulated house. The new house takes care of all the technology-intensive functions such as laundry, bathroom and kitchen. On the roof an Arabian Nights Terrace with North African climate is arranged.

The old building was carefully renovated - both interior and exterior - in accordance with the clients. Floor heating is installed in both buildings. The new building has a concrete slab foundation with a surface of pigmented smooth cast concrete. Generally construction materials with high thermal inertia were selected to counteract temperature fluctuations. Walls are made up of solid light-weight concrete blocks with gypsum plaster on the inside. The roof consists of prefabricated Leca* beams with 100mm hard insulation on top. Topmost is a pressure distributing walkable 30mm layer of concrete.

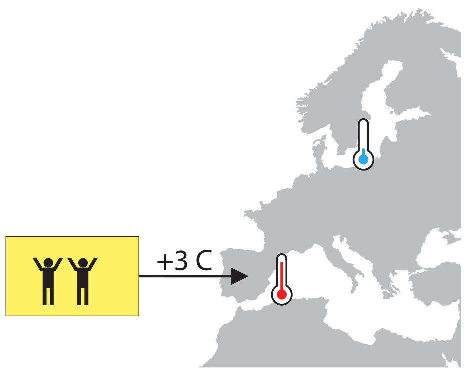
The greenhouse is built with standard components, including climate controlling technology such as automatic vents in the roof ridge and shading textiles with reflective aluminium coating. The ventilation and temperature is controlled by a computer. To avoid overheating in summer the inner house is supplied with pre-cooled air from ducts buried in the ground. During the cold season the same ducts help to pre-heat the fresh air and lower the need for additional heating. In the glazed space there are two climate zones, one at ground level and one - markedly warmer - in the terrace on the roof.

The project has no definite completion date in the traditional sense that project images are taken before the family moves in. On the contrary there has been a gradual realization process going on since 2006 where the garden is prioritized.

The process continues ...

*Leca is an abbreviation for Light Expanded Clay Aggregate - a light building block with beneficial thermal insulation properties.

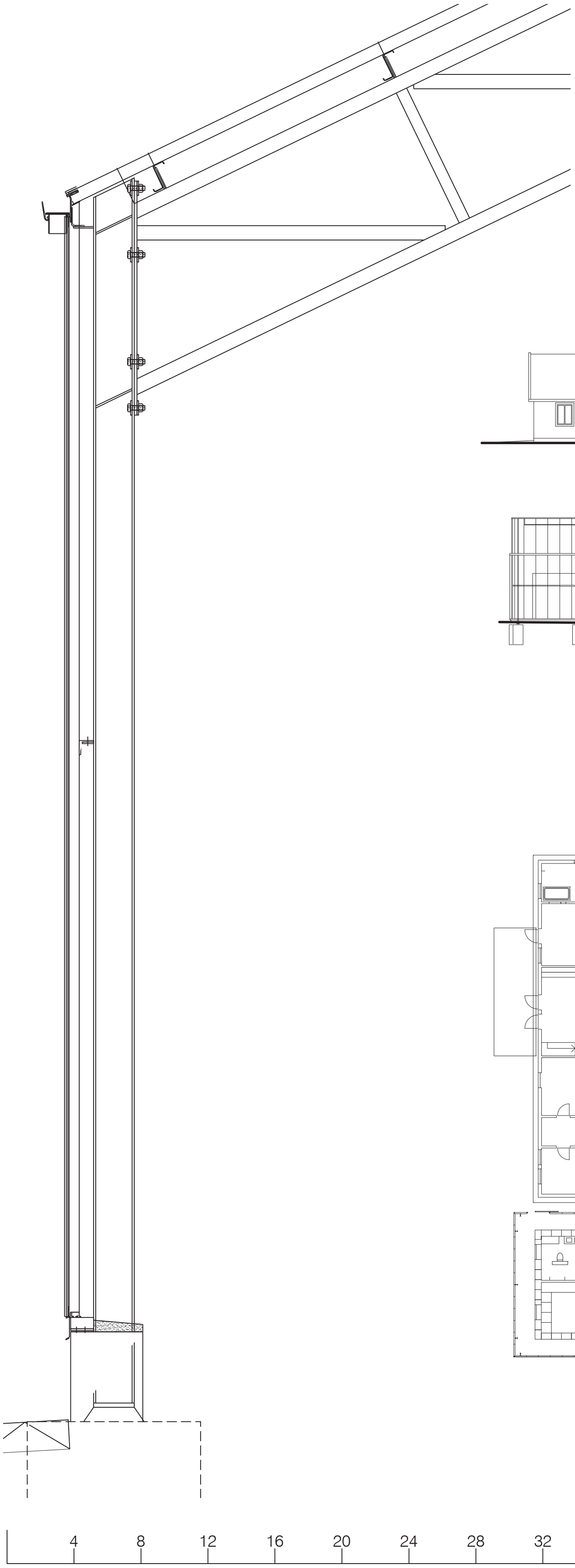
CLIENT:	Karin and Sven-Olav
DESIGN PRINCIPALS:	Klas Moberg & Mikael Frej
AREA:	Glass House 250m^2 Inner Building 70m^2
STATUS:	Exterior finished 2007
	Interior ca 2011
ENERGY CONSULTANT:	DeltaTe
HEATING:	Ground Source Heat Pump

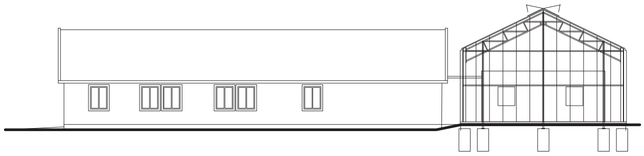


UNIT

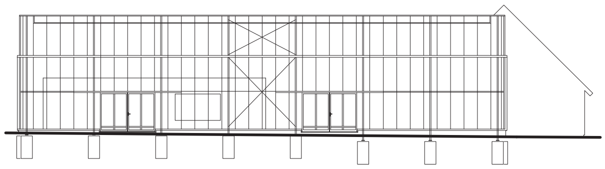
unitark.se

DRAWINGS GLASS HOUSE TRÄSLÖVSLÄGE

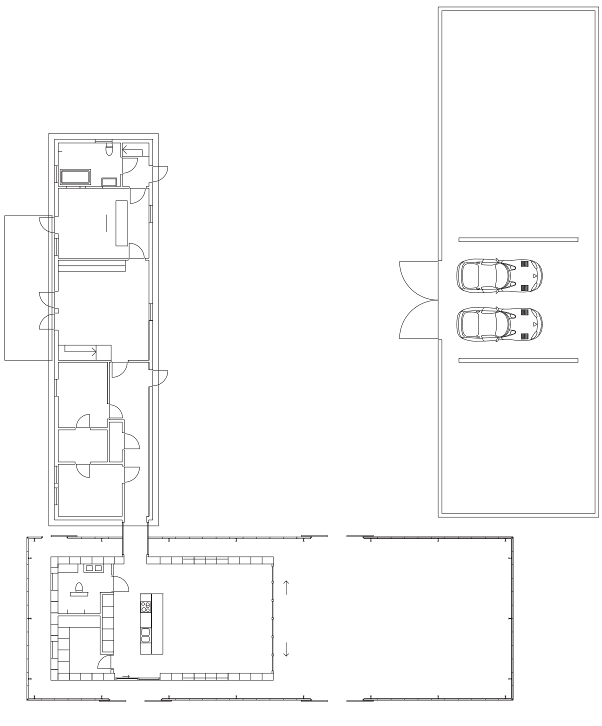




FACADE SOUTHWEST



FACADE SOUTHEAST



GROUND FLOOR PLAN

4 8 12 16 20 24 28 32 36 40m

1:400(A4)

UNIT unitark.se

PHOTOGRAPHY

GLASS HOUSE TRÄSLÖVSLÄGE


©Krister Engström


©Krister Engström


©Krister Engström


©Krister Engström

UNIT unitark.se

PHOTOGRAPHY GLASS HOUSE TRÄSLÖVSLÄGE

©Krister Engström

©Krister Engström

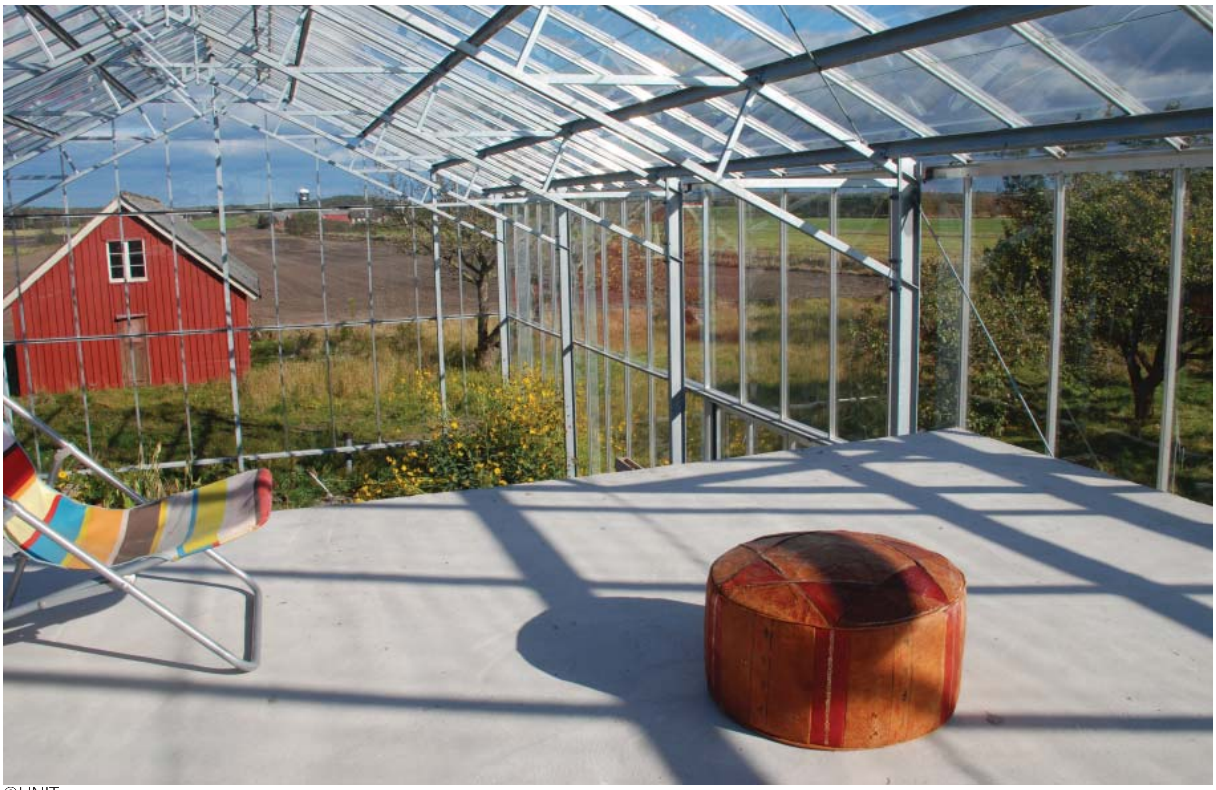
©Krister Engström

©Krister Engström

UNIT

unitark.se

PHOTOGRAPHY GLASS HOUSE TRÄSLÖVSLÄGE



UNIT

unitark.se

TECHNOLOGY

GLASS HOUSE TRÄSLÖVSLÄGE

©UNIT

©UNIT

©UNIT

Understanding the workings of light and energy is fundamental to knowing how a greenhouse works. A greenhouse - as well as our whole atmosphere - is heated by energy radiation emitted by the sun. Half of the energy is in the visible light spectrum and half in wavelengths not visible to the human eye. The energy that radiates through our atmosphere and through the glass of a greenhouse has a spectral composition that is produced by a source several thousands degrees hot - our sun. Through the properties of the glass you can control the amount of heat and visible light to be filtered into the greenhouse. Once the energy has entered the greenhouse it is partly absorbed and converted to heat radiation of a very different spectral composition than solar radiation. Also this can be controlled with glass properties, ie. you can choose to slow the heat radiating out of the building or not. This is determined by the glass emission rates. For an ordinary clear 4mm float glass that is used in this project $\mathcal{E} = 0.84$ (about 4.4 W /m² K) and if you use a low emission glass at $\mathcal{E} = 0.04$ (about 0.2 W / m² K) you will capture the heat more effectively.

Regardless the specifications of the glass the heat loss is slowed by the greenhouse to create a warmer and - in the absence of a shading system - more fluctuating inland climate. It is also true that the climate is governed by the size of the greenhouse, incoming solar energy is squared with increasing size while the enclosed air mass increases almost cubically (depending on height). This means that temperature fluctuations will be less dramatical in a larger greenhouse. In this project the potential overheating of the inside air is regulated in three ways; through manual opening of sliding doors, by the motorized textile shading controlled manually and by opening the vents along the ridge of the roof. These are programmed to be opened automatically at a specified maximum temperature.

The Glass House in Träslövsläge has been the subject of a masters degree work that was divided into two theses. In 2007 Louise Lilja logged temperature and humidity in her thesis for Angela Sasic Kalagasidis at Chalmers University of Technology. The purpose was to study the climate created in a glass house, and initial calculations were made to lay a foundation for a theoretical model of the project. Then Lena Wallin used the data to construct and evaluate a theoretical model of the building in the analysis software IBPT (International Building Physics Toolbox). Once the theoretical model is verified you can use it to simulate the climate in greenhouses of different sizes.

With a functioning system of shading the climat created in the Glass House is equivalent to that of Sevilla or Ankara, ie. an inland climate around latitude 40˚ N. This means that with a little sunshine in January you can sit down to have your coffee wearing t-shirt! Even in Sweden.

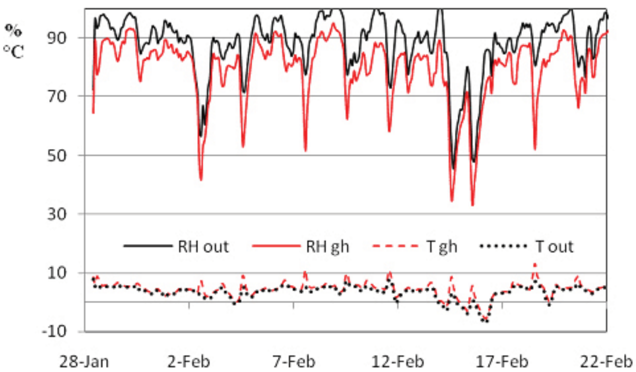
GREEN HOUSE IN SIBERIA

UNIT unitark.se

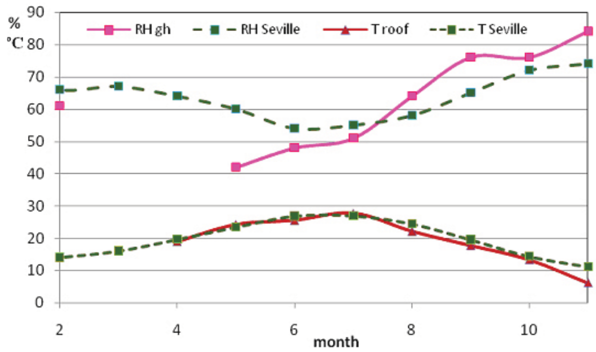
CLIMATE

GLASS HOUSE TRÄSLÖVSLÄGE

The graphs below are extracted from the thesis of Lena Wallin. For full report; go to www.unitark.se.

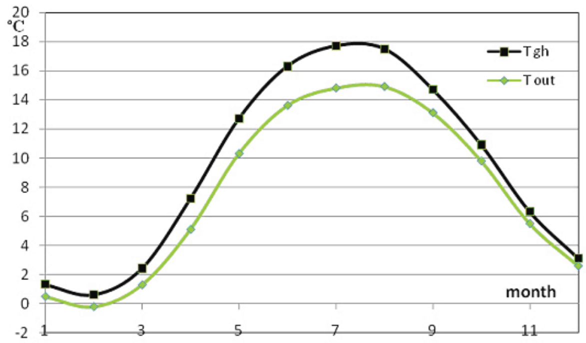


The graph below shows logged temperature in February for the Glass House respectively outdoor temperatures. When the sun appears the temperature reaches 15 C.

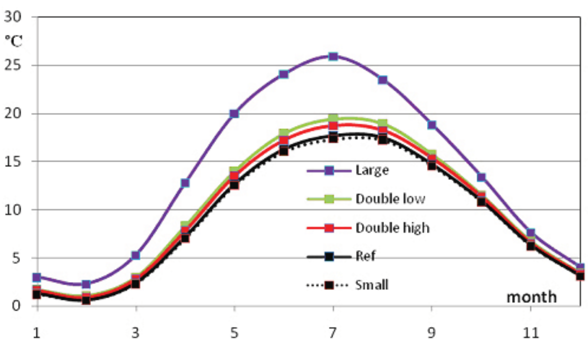


The climate in the Glass House is more or less the same as for Sevilla in Southern Spain.

The two graphs below show the temperature in the Glass House respectively Sevilla over the year. We can conclude that the average temperature is lower in the glasshouse than in Sevilla, in the mid-winter.



A theoretical simulation of the temperature in the Glass House for this project in relation to expected outdoor temperatures.



A theoretical simulation of Glass Houses in different sizes (with no buildings inside them...)

Ref has the same size as in this project.

Large has a 500x500m foot print och a hight of 30m.

The high temperature for the large Glass House is a result of less ventilation per volume unit and that the glass surface is lesser i relation to the volume. Which leads to lower thermal losses.