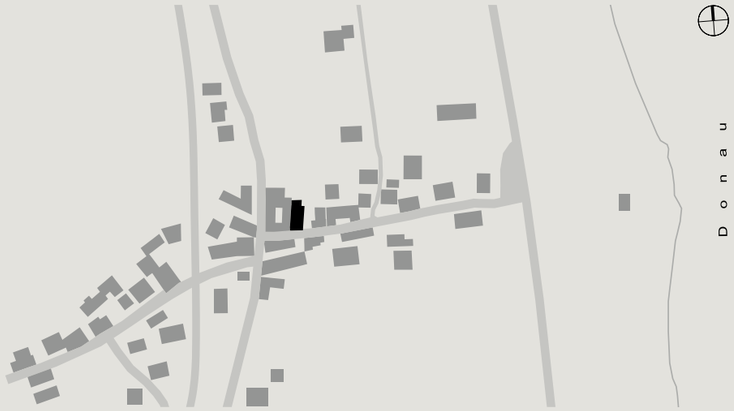
VELUX®

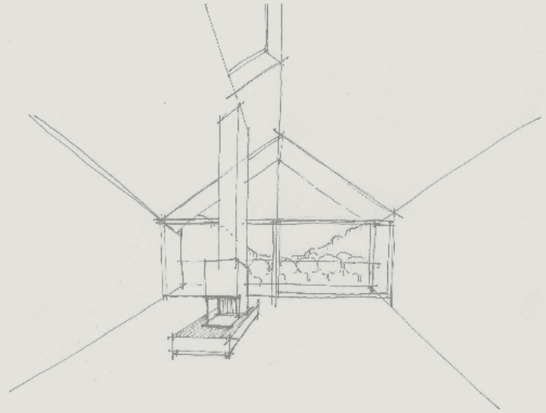
House by the Garden of Venus

Willendorf in the Wachau valley

Location



Site plan



Model study

The small village of Willendorf in the Wachau valley has become famous for its Venus of Willendorf, the most significant discovery of the Upper Palaeolithic found on Austrian soil.

Willendorf is also known for fruit production, especially for its Wachau apricots.

House on a house
A young Willendorf fruit farmer wanted to create a modern loft-like living space in his mother's old farm house in the heart of the village.

A permit had already been granted for the renovation and modernisation of the house to Active House standards by building on the sprawling fruit garden. Instead, he used the building permit to create a sustainable living space by extending the upper floor. It overlooks the fruit crops of the Garden of Venus, which has thus been preserved, and the Danube Valley, to the north.

The House by the Garden of Venus can be seen as a contribution to the reduction of CO_2 emissions and the sustainable re-use of existing rural settlement areas.

Garden view prior to renovation

After renovation

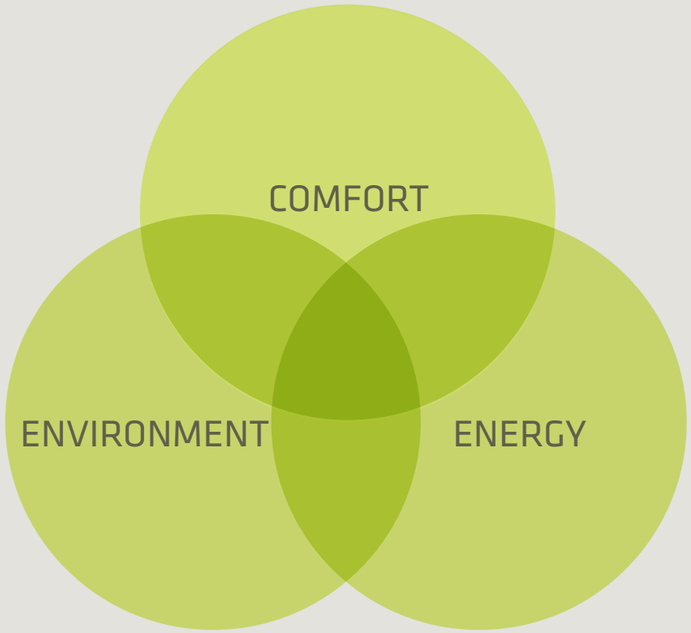
activehouse.INFO
NETWORK AND KNOWLEDGE SHARING

Buildings that give more than they take

Active House is a vision of buildings that create healthier and more comfortable lives for their occupants without impacting negatively on the climate – moving us towards a cleaner, healthier and safer world.

The Active House vision defines highly ambitious long-term goals for the future building stock. The purpose of the vision is to unite interested parties based on a balanced and holistic approach to building design and performance, and to facilitate cooperation on such activities as building projects, product development, research initiatives and performance targets that can move us further towards the vision.

The Active House principles propose a target framework for how to design and renovate buildings that contribute positively to human health and well-being by focusing on the indoor and outdoor environment and the use of renewable energy. An Active House is evaluated on the basis of the interaction between energy consumption, indoor climate conditions and impact on the environment.



The Active House key principles are as follows:

COMFORT

- a building that provides an indoor climate that promotes health, comfort and sense of well-being
- a building that ensures good indoor air quality, satisfactory thermal climate and appropriate visual and acoustical comfort
- a building that provides an indoor climate that is easy for occupants to control and at the same time encourages responsible environmental behaviour.

ENERGY

- a building that is energy efficient and easy to operate
- a building that substantially exceeds the statutory minimum in terms of energy efficiency
- a building that exploits a variety of energy sources integrated in the overall design.

ENVIRONMENT

- a building that exerts the minimum impact on environmental and cultural resources
- a building that avoids ecological damage
- a building that is constructed of materials that can be recycled.

Active House is an initiative supported by the VELUX Group

Architectural Concept

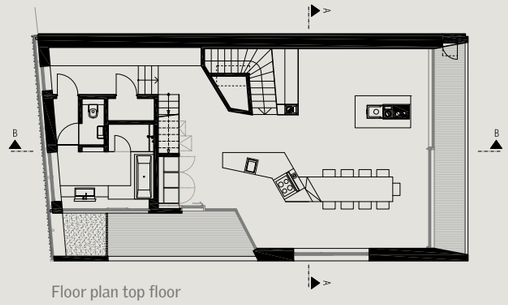
Designer Volker Dienst and architect Christoph Feldbacher responded perfectly to the difficult local conditions. The extension of an existing narrow and historical building led to a "House on a House" concept.

The view towards the Garden of Venus and the use of sunlight were dominant factors in the re-construction plan. The initial situation was anything but easy: the southern side of the building faces the street, it is narrow and there is a high building density; there is an unobstructed view towards the Garden and the Danube, and a huge neighbouring building on the western side.

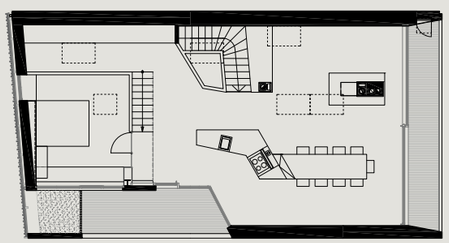
The existing lower storey was transformed into a self-contained, obstruction-free flat that provides dignified and age-appropriate housing for the owner's elderly mother. Several generations living together under one (new) roof, as well as the mixed use as a residential and agricultural building, makes the project Garden of Venus special.

Despite the modern use of forms (exposed concrete was used for the ground floor of the northern annex), the building seamlessly fits into the overall appearance of the townscape.

Due to its glass front and spacious sliding door elements, the elongated new building facing the fruit crops in the Garden of Venus integrates the existing features of the natural landscape and allows a view towards the fruit garden and the parallel Danube Valley. The southern side, facing the village road, is a closed, structured timber facade made of massive silver fir slats, providing privacy and shade. The filtered lighting through the windows installed slightly behind the facade allows the residents to experience the movement of the sunlight.
The slate roof, consisting of small fibre Cement tiles, stretches over the eastern side of the wall and is accentuated by a pixelated graphic of the Venus of Willendorf, which can only be made out from a distance. The courtyard-like balcony on the eastern side, which includes a herb bed, not only serves as a link to the exterior (e.g. towards Aggstein Castle in the south-east), but also provides a variety of views. The loft-like single room concept with its elevated sleeping gallery, below which sanitary and secondary rooms were integrated, absorbs the expanse of the Danube Valley. The continuous gable provides full panoramic views of the surrounding countryside.

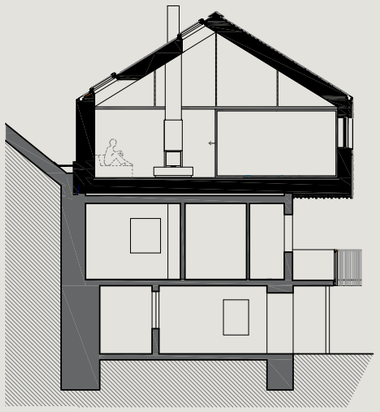


Floor plan top floor



Floor plan gallery

Street view



Section A-A

Daylight Evaluation

Visualisation using VELUX Daylight Visualizer

Visualisation by Volker Dienst

Reality

Daylight Factor

The daylight was evaluated by means of the software VELUX Daylight Visualizer. The evaluation showed that the daylight factor in the living area amounted to an average of 8.5%.

This might sound rather modest – in fact, it is extraordinarily high: DIN 5034-4 recommends a daylight factor of at least 0.95% in the centre of the room. One striking feature of this project is the evenly-spread lighting, that makes the room seem even brighter.

Despite the high building density, the importance of daylight and the creation of appropriate privacy, including a strong connection to the natural environment, were crucial goals of the planning team and the building owner. Accordingly, all areas of the top floor have been designed to be adequately supplied with daylight – even on cloudy days. The top floor is illuminated via the glass generously used for the gable wall on the northern side, which also provides an uninterrupted view of the apricot garden and the Danube Valley. Horizontal ribbon windows on the eastern side and strategically placed roof windows on the western side were added to admit light onto the depths of the room. This strategic use of zenith light creates daylight of high quality that reaches as far as the ground floor through a light shaft in the staircase. Zenith light, that is light coming from above, provides three times as much daylight on a cloudy day as light coming from the side.

In several countries, the daylight factor (DF) is one of the simplest and most common methods of measuring daylight. The DF defines the percentage of daylight from an overcast sky that will be available indoors on a plane 85 cm above the floor. The higher the daylight factor, the more daylight is available in the room. Rooms with an average daylight factor of 2% or more are considered to be adequately lit. A room is considered to be really bright if the DF is 5% or more.

For more details and download, visit **http://viz.velux.com.**

Energy

The newly-built top floor is made of wood elements with a high level of thermal insulation. The thermal rehabilitation of the facade of the ground floor resulted in modern energy standards for the entire building.

During the heating period, ventilation is provided by means of controlled domestic ventilation, including a high level of heat recovery.
In the summer months and transitional seasons, turning off the ventilation system helps to save energy. Air is exchanged via the windows; those on the facade are operated manually, while the roof windows are operated electronically.

For the time being, the pre-existing wood gasification boiler and oil-fired boiler are still being used to meet residual heat requirements and water heating. However, as the next step in the process of renovation, all necessary constructional preparations have already been made to replace the existing heating system with pellet heating or a geothermal heat pump. Heat distribution is achieved by means of low-temperature underfloor heating. Fuelled with local wood, a fireplace not only creates a cosy atmosphere, it also matches perfectly the overall energy concept.

Protection against summer heat
Particular attention has been paid to this topic. Partly because of the favourable climate in the Wachau valley, one of Austria's hottest regions, and partly because of the relatively high percentage of glazed area.

The lower section of the southern facade is shaded by the neighbouring building to the south, while the facade of the upper section of the new extension is shaded by wooden spats installed at the front. With a reduction factor of Fc=0.04, 96% of the irradiated energy will be blocked out. Shutters on the roof windows offer the best protection on midsummer days. And awnings protect the terrace on the eastern side and the area behind it against excessive heat.

Night-time cooling works efficiently by using the stack effect of the fireplace. Fresh air comes in through opened windows on the facade and stale air is exhausted at the highest point of the house through the electronically-operated roof windows. Their opening is time-controlled, which means that the house is also ventilated in the evening, before the residents even arrive home. Rain sensors close the windows automatically.

Energy Balance

Solar heat gain
(g-value)

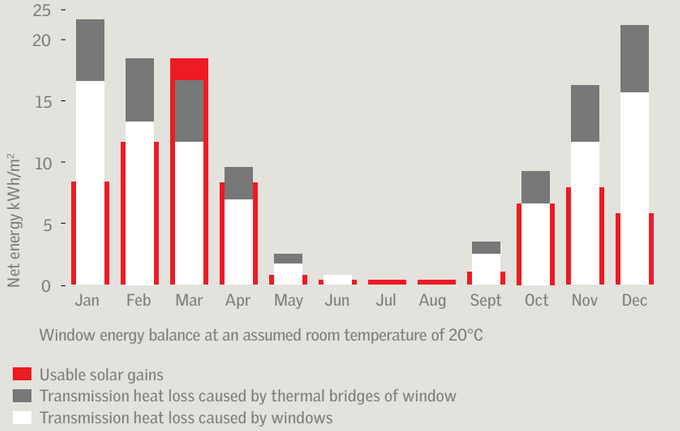
Heat loss
(U-value)

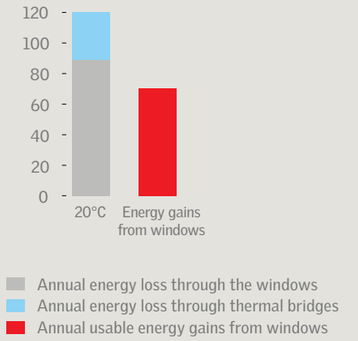
Energy balance

However, many experts in the building industry still consider windows as a "weak point" and a source of heat loss. Actually, what is decisive is the balance between the transmitted heat losses through the window (U-value), including the thermal bridges resulting from installation, and the usable solar gain (g-value) during the heating season.

The Department for Building and Environment at the Danube University Krems has evaluated the energy balance of the roof windows in the House by the Garden of Venus as follows:

Monthly Window Energy Balance





All the roof windows on the western side were incorporated into a roof with an inclination of 34°. The evaluation shows that thermal losses can be mostly compensated by solar gains, especially during transition seasons, and that the windows can even be considered as a net energy gain area in March.

During the winter months, losses cannot be completely compensated. However, the fall in energy balance can be reduced by a third.

Thus, in the project Garden of Venus, one m^2 of window area has a negative energy balance of 43 kWh per year at a room temperature of 20°C. This means that, throughout the year, approximately two thirds of the heat losses of 120 kWh per m^2 roof window can be compensated through usable solar gains of 77 KWh. By using more storage mass, those windows could increase the usable solar gains and further improve the energy balance.

Roof windows used in this project:
- Wooden windows of Nordic pine with external aluminium cladding
- 3-layer glazing with krypton gas filling
- Uw = 0.91 W/m²K
- Ug = 0.5 W/m²K
- Uf = 1.5 W/m²K
- g = 53%
- tv = 70%
- Ψ = 0.06 W/m

Environment

Materials and ecology
This modern densification in the central settlement area (town centre) represented a particular challenge for the designers and building contractors. A short construction time, supply problems and construction difficulties complicated the project.

For this reason, but also out of consideration for the environment, the building owner and the architects decided to construct the top floor of the new building, which protrudes on two sides, using a prefabricated wooden modular design with massive glulam ceiling elements. Due to static requirements, these elements span between five steel frames. Wood-fibre insulation provides high-quality ecological insulation of the roof.

Volker Dienst and Christoph Feldbacher made extensive use of untreated local wood for the interior construction and furnishing, with remarkable attention to detail. The spatial flow is enhanced by the natural silver fir panels applied horizontally on all the ceilings and walls. The floor also consists of natural rough-sawn silver fir panels. The tailor-made, very minimal furnishing and the design of the stairs also incorporate silver fir and are further examples of precise manufacturing and the high level of craftsmanship of Vorarlberg's wood construction companies. Only the central kitchen unit, made of Corian that complements beautifully a natural oak table, puts an accent on colour and material. The dining table also reflects the oak balustrade on the balcony.

A 14th-century natural stone wall was revealed in the basement and integrated into the architecture.

holz bau preis 2014

In May 2014, the House at the Garden of Venus was awarded the Lower Austrian timber award (niederösterreichischer Holzbaupreis) in the category rebuilding, expanding and renovation.

Active House Radar

The Active House Radar shows at a glance to what extent the individual criteria Comfort, Energy and Economy have been met.

This figure also shows in which way the parameters within the individual criteria are interconnected.

Comfort

- Daylight
  The House by the Garden of Venus provides excellent daylight conditions. Even in the event of an overcast sky, the top floor appears extremely bright and evenly illuminated.
  Despite dense development, the rooms on the top floor are penetrated by a large amount of direct sunlight during winter.
- Thermal environment
  Thanks to the roof windows' external shutter sunscreening, a wooden parapet along the southern facade and an awning on the eastern terrace, the solar load can be considerably lowered in midsummer. Targeted night-time ventilation via strategically-positioned windows (ventilative cooling), makes it possible to keep room temperatures below 26°C for 98% of the time. Heating can be regulated in a user-friendly way to attain comfortable room temperatures.
- Indoor air quality
  A mechanical ventilation system during the heating period, and adequate automated window ventilation during transition seasons and the summer, provide for the building's excellent air quality, with a CO_2 concentration of merely a few hundred ppm coming from outside air – a figure that is clearly below 1,000 ppm. All internal surfaces are made of natural wood and are thus virtually emission free.

Energy

- Although the building has a highly heat-insulated envelope, it is only suitable, and to a limited extent, for the active use of solar gain, mostly due to its orientation, with a narrow south-facing gable fronting onto the village street. For heating, water heating and electricity applications, the total energy consumption is 82 kWh/m²a.
- Due to the orientation of the existing building, thermal collectors and/or photovoltaics would not be useful. However, preparations for a solar system on the neighbouring building have already started. Heating comes from renewable energy in the form of wood taken from the owner's woods.
- In addition to the wood furnace, there is also an oil-fired boiler, which will be used until it comes to the end of its working life. The transition to renewable energy sources in the form of an efficient geothermal heat pump is already provided for.

Environment

- A detailed Life Cycle Analysis certifies that the building has a very good environmental balance.
- Reducing water consumption without losing comfort is ensured by water-saving fittings.
- Owing to the lightweight construction of the new extension, which is made entirely of local wood, more than 75% of the building can be recycled at the end of its lifespan.
- The most important environmental fact: no building has been built on the fruit garden, which is authorised for building. The new building unit was realised in the form of an upper-storey extension, resulting in an intelligent densification.

Building Process

Thanks to close cooperation with a very conscious and committed building owner, Volker Dienst and architect Christoph Feldbacher have created a showcase project with the Garden of Venus.

It is exemplary in many aspects. Valuable grassland could be preserved and an aged building now radiates new splendour. The architecture is also exemplary. Despite the contemporary exterior design, it is smoothly integrated into the heart of the village; inside, the building is an architectural gem, with the walls, ceilings and furniture conflating into a harmonious entity.

The villagers' acceptance of the project was described most accurately by the 93-year-old neighbour: "It is only at this age that I finally see something this beautiful." This novel concept is intended to provide impetus for other gentrification processes of village and city centres beyond Willendorf.

The silver fir walls, ceiling and furniture merge into a harmonious entity

House by the Garden of Venus

Planning and site supervision:
Volker Dienst, Inprogress Architektur Consulting, 1180 Vienna
In collaboration with
Christoph Feldbacher, thesophtloft, 1070 Vienna
Assistance: Anna Ciniero

Static:
Merz kley partner ZT GmbH, Dornbirn
Ingenieurbüro KRAM GmbH, Hainfeld

Daylight planning:
VELUX Österreich GmbH, Wolkersdorf

Artificial light planning:
Podpod design, Vienna

Building concept:
Active House Standard

Floor space:
Top floor 124m²

Construction period:
September 2012 until May 2013

Wooden structure and interior construction:
Kaspar Greber Holz- und Wohnbau GmbH, Bezau
Tischlerei Herbert Feuerstein, Bizau (Carpentry)
Tischlerei Ing. Gerhard Graschopf GmbH, Gresten (Carpentry)

Photos:
Jörg Seller: architectural photography
Volker Dienst: model photographs and site photographs
Stella Maris: photos of the existing building
Lois Lammerhuber: Venus of Willendorf
Phoenixpix: aerial photographs of Willendorf

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