Home for Life

VELUX®
MODEL HOME 2020

Address
Elmehaven 1
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Denmark

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Illustrations of Home for Life
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Photos of the Simonsen family
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Other photos and illustrations
The VELUX Group

The house that gives more than it takes
Home for Life in Lystrup near Århus, Denmark, is a new CO_2 neutral one-family house with a special focus on indoor climate.

Home for Life was developed by the VELUX Group and VELFAC in cooperation with aart arkitekter and Esbensen Consulting Engineers. The house is the result of an interdisciplinary project to incorporate the issues of energy, comfort and visual appeal into a holistic entity in which these parameters supplement each other and give the best possible quality of life in the home and its surroundings.

Home for Life represents in many ways the aspirations of homeowners in the early 21st century. It is home to the Simonsens, a family of five, with a large, undivided living space on the ground floor and individual rooms above.

Home for Life is the first of six buildings in Europe to be constructed as part of the Model Home 2020 experiment.

Daylight, energy and indoor climate
The look and feel of the house is an interpretation of the typical home as a futuristic 'energy machine' that interacts with the surroundings outside and the life going on inside.

The active facade changes the appearance of the house and its spatial relationships according to the time of year and the needs of the residents. All the rooms contain windows facing in at least two directions, and besides being an entrance point of light, they also function as an exit.

In Home for Life the borders between inside and outside are dissolved. The windows and patio doors that reach to the floor make inside and outside flow together so the room appears larger and more airy, while the windows that go completely to the ceiling, together with the roof windows, ensure that the daylight flows deep into the rooms.

Ventilation
There is generous provision of fresh air in Home for Life. In the winter, fresh air enters via the mechanical ventilation system with heat recovery, is then circulated into the bedrooms and living rooms and exhausted from the utility rooms (kitchen, bathroom, laundry room). In the summer, natural ventilation replaces the mechanical system, thus reducing energy consumption. It is controlled by an indoor sensor that ensures the house is not ventilated more than necessary at the same time as maintaining a good indoor climate.

Many details in Home for Life have the goal of maximum possible transparency: it is possible to look through the staircase towards the entrance to the building.

Follow the project, visit www.velux.com/modelhome2020

The Simonsen family moved into Home for Life on 1 July 2009. "We are not particularly idealistic or green but we are influenced by the current debate on reducing CO_2 emissions," explains Sophie Simonsen. "So when we were given the offer to move here, we thought it was a marvellous opportunity to do something worthwhile. Here we are part of the future and I hope that, in the long term, it will inspire our children."

As a part of the Model Home 2020 experiment, the Simonsens will live in the house for a full year while it is measured and tested. The five members of the family are the first to live out the visions of Home for Life and follow the course of the year – with sun, wind, rain, grey days and bright days – in their new house. They are excited to see whether the improved indoor climate and extra fresh air will improve their everyday life.

Measurements, observations and interviews

Home for Life is being scientifically monitored to maximise experience and share of knowledge in a team from The School of Engineering in Århus,the Alexandra Institute, VELFAC and WindowMaster. Engineers and anthropologists are studying how the Simonsens interact with their new home, especially with the intelligent building operation system that controls the heating, lighting, ventilation and sun screening. They also measure the actual energy use and energy production of the house as well as numerous factors of the indoor climate, such as light levels, air temperature, CO_2 concentration and humidity. At the same time, outdoor environmental factors such as solar intensity, air temperature, humidity and wind speed are constantly measured to assess their influence on the energy balance and on the indoor climate.

First results

Data on the first six months' energy production, energy consumption, temperatures and CO_2 emissions are collected. During this time, the house is continuously adjusted to perform according to the family's needs and well-being. The highest priority has been given to ensuring the framework for family life, with the corresponding data on energy consumption and other figures coming further down the list.

Home for Life features new products, new technologies and several prototypes that were used here for the first time and in a unique constellation. This is an important aspect of the experiment and reflects the aim to gain knowledge by testing theories as well as to acquire and share experience through innovation.

Follow the Simonsen family in Home for Life.
Read their diary on www.velux.com/modelhome2020

Some of the Simonsens suffer from allergies, hay fever and respiratory problems, so everyone is looking forward to seeing whether the indoor climate and the choice of materials in the house will alleviate these problems. "We are excited to see whether the good ventilation and correct materials play a role and whether we will see a general improvement in our health and well-being. We need to go through a pollen season before we can arrive at a valid opinion. But we did notice from the very first night that the air in the house is good. The rooms are comfortable all the time because the warm air is ventilated and you can adjust the indoor climate to suit the outside," says Sverre Simonsen.

Sverre and Sophie follow the screen information on energy production and consumption. It is important for the family to try to meet the performance target of the project and it gives them great joy when they see that the house produces energy and that their own energy consumption has fallen. "On Sunday it was evident when the sun came out. I just had to take a look: does this really influence energy production? Yes! It does! That was a real 'yippee!' experience! It is actually really good fun and wonderful, just wonderful [...]. These small experiences: yes, they make a difference, there is something in our house producing, there is some sense to all this. Something truly sustainable, it is great!"

Daylight

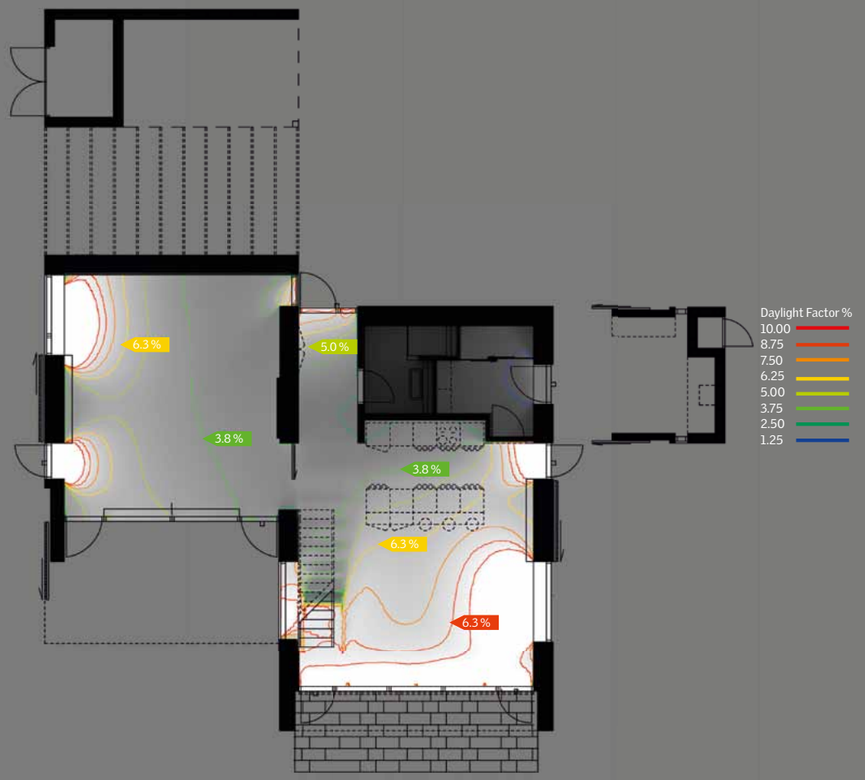
The use of daylight has been optimised to ensure the health and well-being of the residents as well as to minimise the need for electric light during the day. The house has 190 m² distributed over 1½ storeys. The window area amounts to 40 % of the floor area (as opposed to the usual 20-25 %), with the windows placed in all four facades as well as the roof to ensure plenty of natural light, distributed deep into all rooms.

Home for Life uses energy-optimised windows, with linings that transmit light deep into the rooms. The south-facing roof overhang creates shade from a high summer sun and admits light from a low winter sun.

Shutters and blinds regulate solar heat and ensure privacy when needed. The size and placement of the windows have been determined by the position of the sun in the sky, seasons, energy optimisation and the needs of the residents.

Blinds and roller shutters enable the residents to control daylight, heat intake and heat loss – all factors that have an influence on indoor climate. Blinds and roller shutters can reduce the heat loss through the window by up to 34 %, depending on the type of window pane, blind or roller shutter, ensuring improved insulation during cold winter nights.

To secure that the Model Home 2020 projects meet the expectations in terms of daylight quality in the homes, the daylight levels are evaluated and defined via simulations in VELUX Daylight Visualizer 2 and model studies in a light lab.



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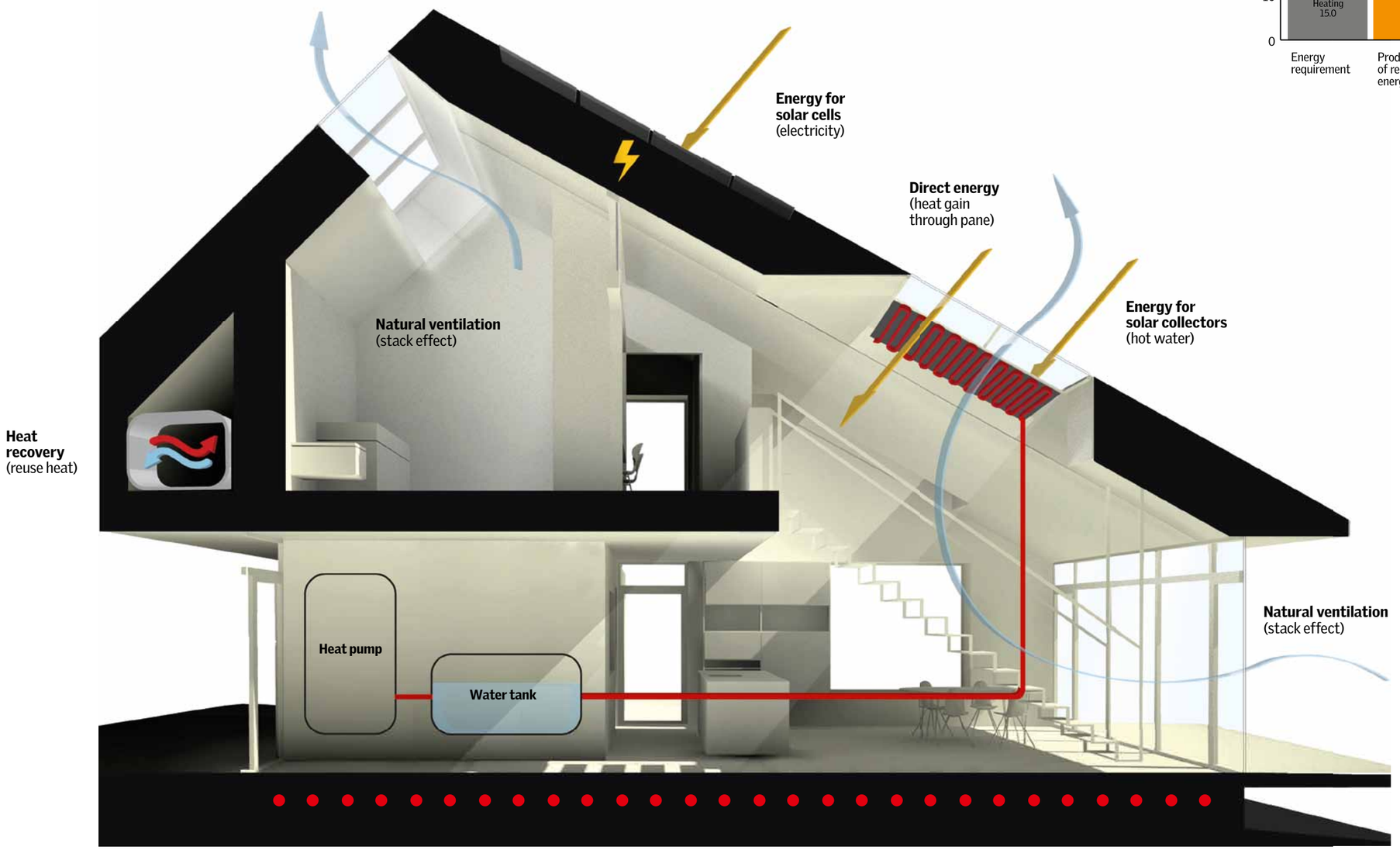
Energy concept

The total energy consumption is reduced to a minimum and met by renewable CO_2-neutral energy generated by the building itself. After some 30 years, the surplus energy is equivalent to the amount of energy represented by the materials from which the house is built.

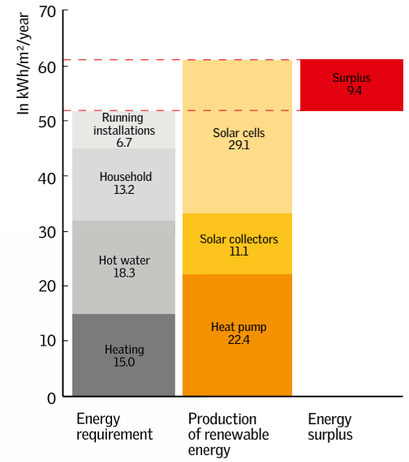
A primary parameter in the energy design is the fenestration; positioned to cater for energy technology and visual appeal, the windows optimise light, air and heat gain. The house is managed in such a way that electricity and heat are used to a minimum. In the summer, the automatically controlled natural ventilation is used to air the rooms. During the heating season, mechanical ventilation with heat recovery is used, so the cold air can be heated without the use of additional energy. Intelligent control regulates the outdoor and indoor sun screening for optimising heat and light intake as well as switching off lights when the room is not in use.

All roof windows in Home for Life are equipped with io-homecontrol®, an electronic control system that helps ensure a comfortable indoor climate and minimal energy consumption, e.g. by closing windows and blinds at night to avoid heat loss, thus minimising energy loss at night considerably.

- Solar cells, solar heating and a heat pump produce electricity, hot water and room heating
- About 50 % of heating requirements are met by passive solar heat from the energy-optimised windows
- Natural and mechanical ventilation, combined with internal and external sun screens, ensure fresh air and a good room temperature
- The house's control system reduces energy consumption and ensures a healthy indoor climate.



Home for Life produces an annual energy surplus calculated at 9.4 kWh/m²/year.



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Products

Bedroom 2

2 triple-glazed centre-pivot roof windows with white polyurethane finish and solar window operators (GGU U04 006530)
2 solar window operators (KSX 100)
2 frame extensions (LGI U04 2000)
1 installation set (BDX U04 2010)
2 vapour barrier collars (BBX U04 0000)
1 special flashing set for 2x2 roof windows in both bedrooms (EBLX99 U04)
2 solar blackout blinds (DSL U04 1025)
2 solar awning blinds (MSL U04 6080)

Bedroom 1

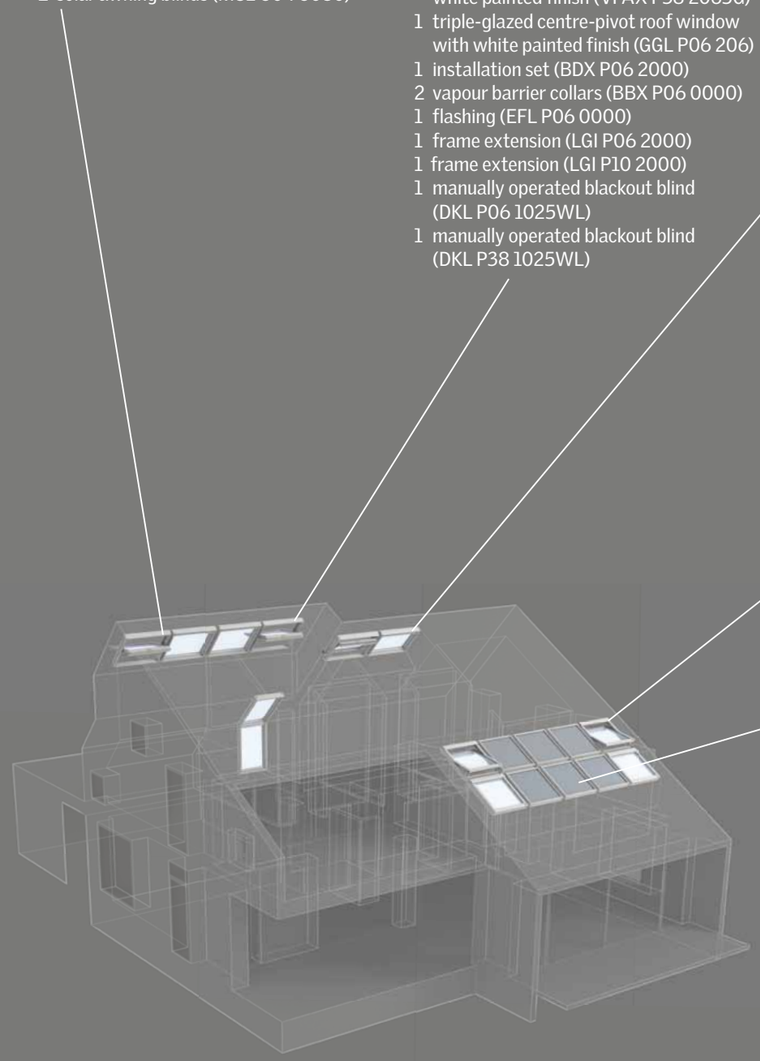
2 triple-glazed centre-pivot windows with white polyurethane finish and solar window operators (GGU U04 006530)
2 solar window operators (KSX 100)
2 frame extensions (LGI U04 2000)
1 installation set (BDX U04 2010)
2 vapour barrier collars (BBX U04 0000)
2 solar blackout blinds (DSL U04 1025)
2 solar awning blinds (MSL U04 6080)
1 triple-glazed facade window with white painted finish (VFAX P38 2065G)
1 triple-glazed centre-pivot roof window with white painted finish (GGL P06 206)
1 installation set (BDX P06 2000)
2 vapour barrier collars (BBX P06 0000)
1 flashing (EFL P06 0000)
1 frame extension (LGI P06 2000)
1 frame extension (LGI P10 2000)
1 manually operated blackout blind (DKL P06 1025WL)
1 manually operated blackout blind (DKL P38 1025WL)

Bathroom

2 triple-glazed centre-pivot roof windows with white polyurethane finish (GGU U04 0065)
1 solar window operator (KSX 100)
2 frame extensions (LGI U04 2000)
1 installation set (BDX U04 2010)
2 vapour barrier collars (BBX U04 0000)
2 solar roller blinds (RSL U04 4070)

Kitchen-dining room

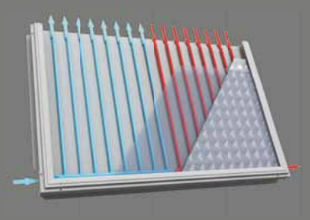
4 triple-glazed centre-pivot roof windows with white polyurethane finish and solar window operators (GGU S06 006530)
4 solar window operators (KSX 100)
4 frame extensions (LGI S06 2000)
4 installation sets (BDX S06 2000)
4 vapour barrier collars (BBX S06 0000)
7 combi flashings for roof windows and solar collectors (EKL S06)
3 combi flashings (EKX S06)
4 solar awning blinds (MSL S06 6080)
4 solar roller blinds (RSL S06 1028)



Thermal solar energy

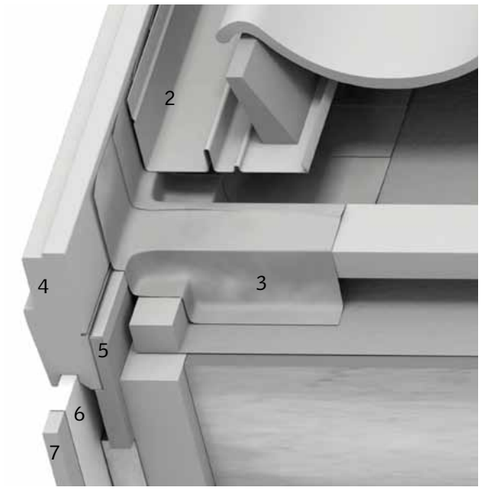
6 solar collectors (CLI S06 4000) and flex-tubes for solar collectors (ZFR + ZFM 020)

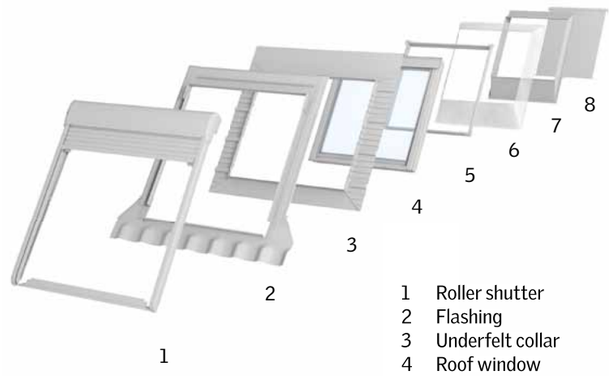
The VELUX solar energy systems for domestic hot water and room heating were designed to maximise efficiency, aesthetics and convenience. It uses the sun's energy to heat up the water used in the building, meeting up to 70 % of the requirement for domestic hot water.



The house is built with a light wood construction, with load-bearing I-beams in wood and beams/joists in laminated wood. In areas subjected to particular strain, steel beams are used. Stability and slice effects are obtained with the use of plywood mounted on the I-beams on the roof and outer walls. Corbels around the balcony and utility room on the first floor are built with load bearing laminated wood. The corbel over the kitchen/family room is built as a steel frame.

System solution





1 Roller shutter
2 Flashing
3 Underfelt collar
4 Roof window
5 Insulation collar
6 Vapour barrier
7 Lining
8 Interior sunscreening

Figures
The chart shows the technical characteristics of the VELUX roof windows in relation to heat loss, passive heat gain and daylight. The heat loss (U_w) of the roof windows is influenced by the roof pitch. The heat gain (g-value) and light transmittance (Tau) are not affected by the orientation or roof pitch.

Roof windows with pane --65

Roof pitch	90°	30° (South)	45° (North)
U_w (Heat loss U-value window)	1.0 W/m²K	1.1 W/m²K	1.1 W/m²K
U_g (Heat loss U-value pane)	0.5 W/m²K	0.7 W/m²K	0.6 W/m²K
g (Heat gain g-value)	0.45	0.45	0.45
Tau (Light transmittance)	0.67	0.67	0.67

Outer walls		
U (Heat loss U-value)	0.1 W/m²K	(395 mm insulation)
Roof		
U (Heat loss U-value)	0.07 W/m²K	(540 mm insulation)
Floor slab		
U (Heat loss U-value)	0.07 W/m²K	(500 mm insulation)

Fenestration	
Window area	75 m²
Floor area	190 m²

The window area is equivalent to 40 % of the floor area.

Building owner:	VKR Holding A/S
Partners:	VELFAC and the VELUX Group
Architects:	aart
Energy concept:	Esbensen Rådgivende Ingeniører
Turn-key contractor:	KFS Boligbyg

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