

Home for Life

Aarhus, Denmark

VELUX®
MODEL
HOME 2020

Home for Life is the result of an interdisciplinary project to synthesise the parameters of energy, comfort and visual appeal into a holistic entity, where the parameters are mutually complementary and maximise the quality of life in the home and the world around it.





Life, light and air reflected in the architecture.

The house has 190 m² of floor space, distributed over 1 ½ storeys. The window area (vertical windows and roof windows) is equivalent to 40% of the floor area.

The principal architectural idea in Home for Life is to unite single-family house requirements to experience, functionality and energy consumption in an integrated design. It is the light incidence, the active facade, the relationship between indoors and out and the flexibility of the house that gives it its high architectural quality.

The look and feel of this demonstration home is an interpretation of the archetypical residence as a futuristic 'energy machine' that interacts with nature and the life lived inside it.

The active facade

The choice of slate covering on the facade and roof reflects both the wish for durability, low CO₂ influence and minimal maintenance, and the wish to integrate the dark surfaces of the solar cells, the solar panels and the windows in a sculptural composition. The wood covering and wood flooring, with their feeling of natural warmth, provide a contrast to the hardness and cold expression of the slate.

The active facade changes according to the seasons and needs. It can either be open to let in light and heat, or it can be closed to screen against the sun and retain heat during the night.



Experiment # 1



Daylight

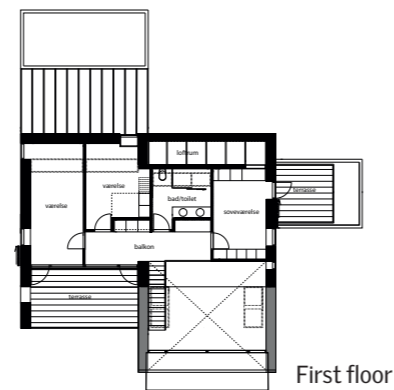
The use of daylight has been optimised to ensure the health and well-being of the residents as well as to minimise consumption of electric light during daytime. The window area amounts to 40% of the floor area (as opposed to the usual 20-25%), with the windows placed in all four facades as well as the roof to ensure plenty of natural light, distributed deep into all rooms. Daylight levels are evaluated and finally defined via simulations in VELUX Daylight Visualizer 2 and model studies in a light lab.

Home for Life uses the energy-optimised windows of the future, with linings that transmit light deep into the rooms. The house's active facades regulate light and heat gain. 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. Furthermore, the risk of glare is avoided with screening both inside and outside.

Ventilation

There is generous provision of fresh air in Home for Life. In the winter, the air enters via the mechanical ventilation system with heat recovery. The equipment is programmed to adapt to the ventilation needs of the rooms. The air is circulated into the 'clean' rooms (bedrooms and living rooms) and exhausted from the utility rooms (kitchen, bathroom, laundry room). In the summer, fresh air enters through natural ventilation controlled by a sensor in the house; this ensures that it is not ventilated more than necessary at the same time as maintaining a good indoor climate. The natural ventilation replaces the mechanical system during summer and reduces energy consumption.



First floor



Ground floor



Experiment # 1

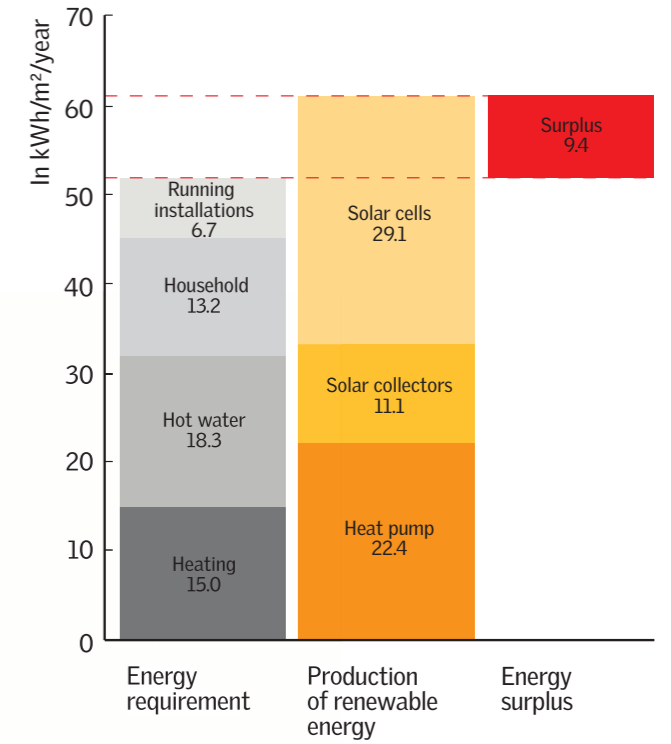
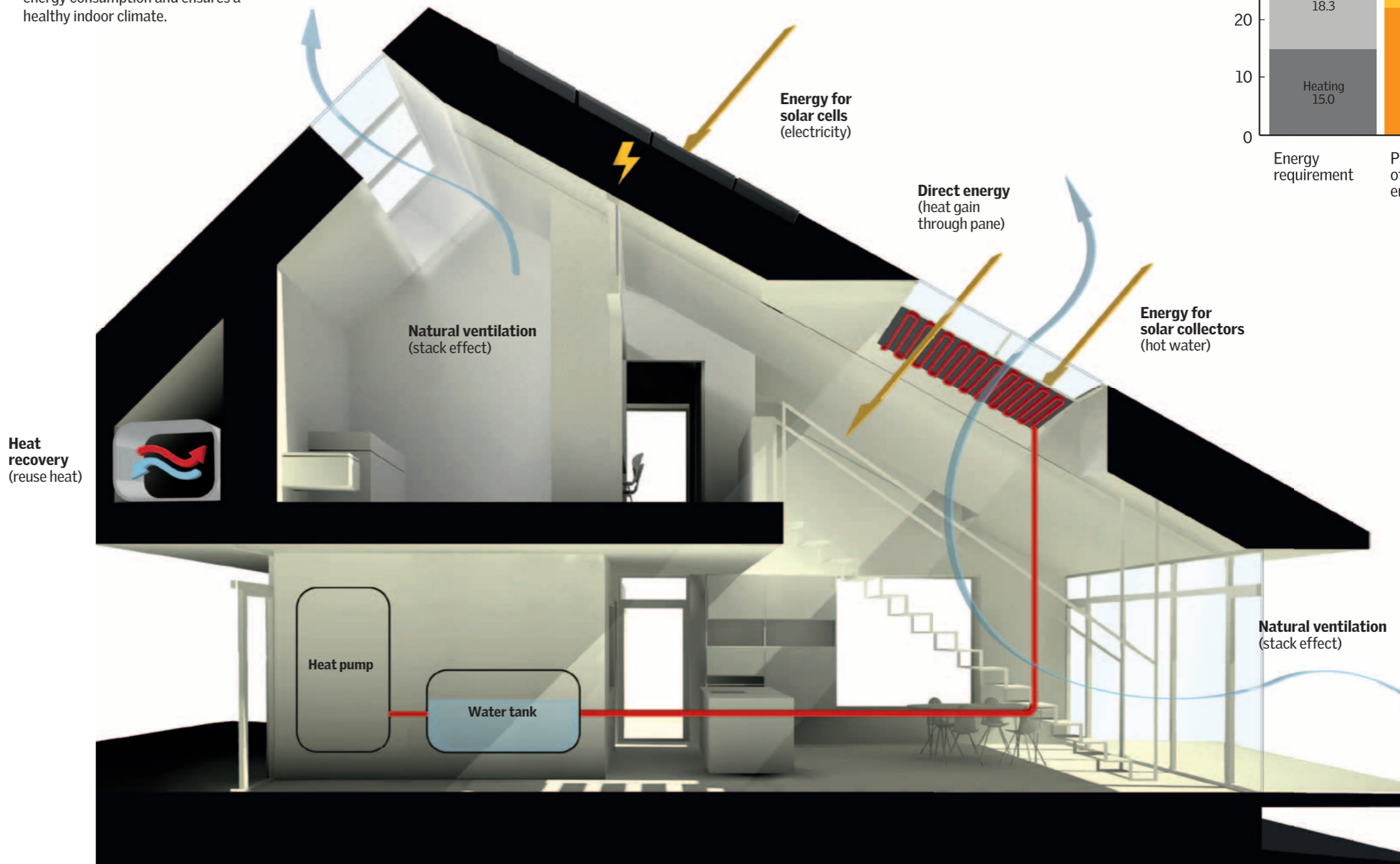
Energy

The total energy consumption is minimised and met by renewable CO₂-neutral energy generated by the building itself. After around 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 window area is equivalent to 40% of the heated floor area.

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 for airing 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 the light when the room is not in use.

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

- 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, as well as internal and external sun screens ensure fresh air and a good room temperature.
- The control system for the house reduces energy consumption and ensures a healthy indoor climate.



Experiment # 1

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 black-out 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 black-out 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 black-out blind (DKL P06 1025WL)
- 1 manually operated black-out blind (DKL P38 1025WL)

Bathroom

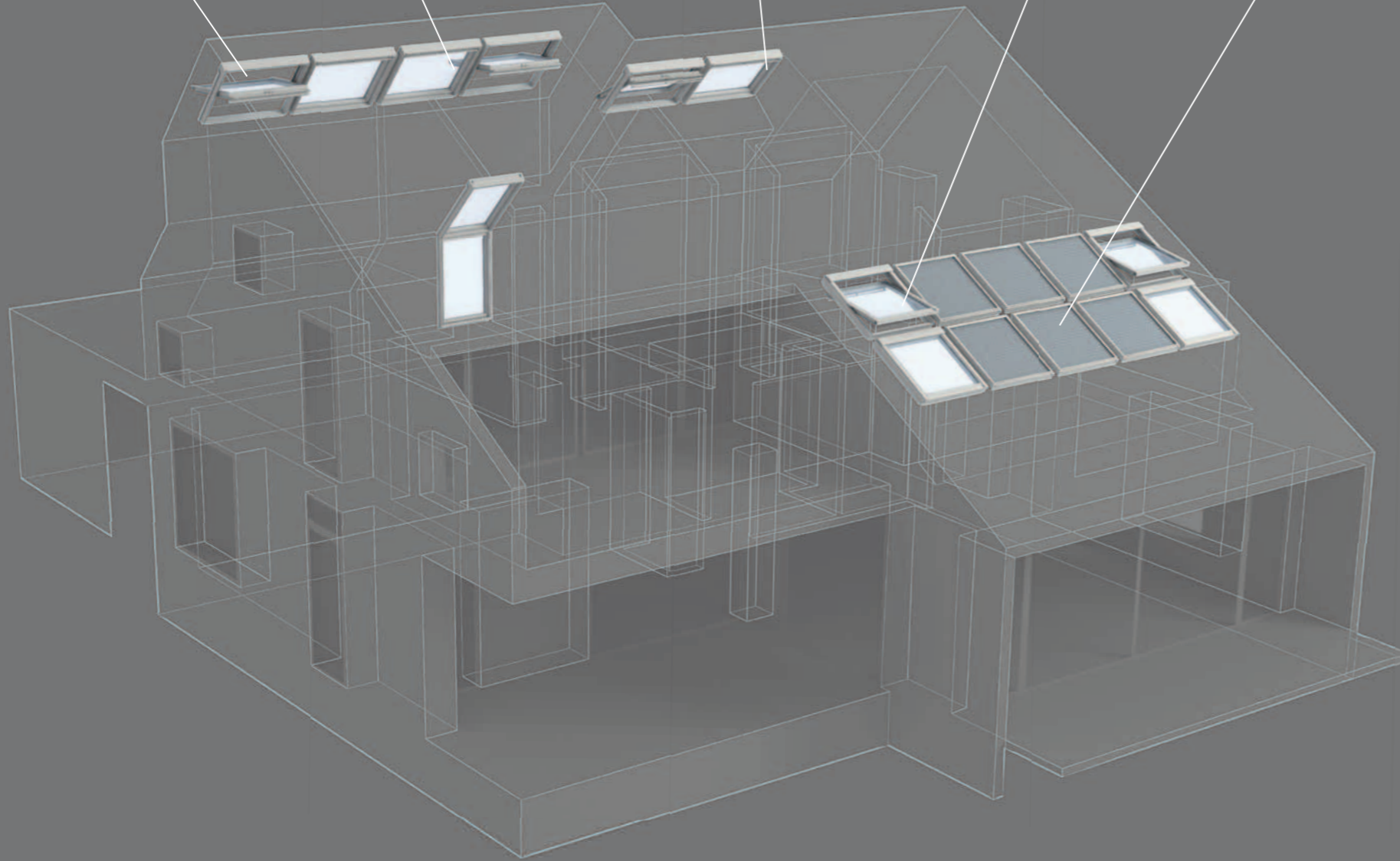
- 2 triple-glazed centre-pivot roof windows with white polyurethane finish (GGU U04 0065)
- 1 solar window operator (KSX 100)
- 2 frame extensions (LGI U04 2000)
- 1 installation set (BDX U04 2010)
- 2 vapour barrier collars (BBX U04 0000)
- 2 solar roller blinds (RSL U04 4070)

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)



Next step

From 1 July 2009 until 30 June 2010, Home for Life will be tested on site. A family of two adults and two children will be moving in and spending their lives in the house.

Measurement of energy use and production

The first part of the test is a monitoring and measurement programme that will show how much energy is used and produced in the house. This will enable conditions, calculations and assumptions to be examined and subsequently validated. The Engineering College of Aarhus is responsible for the measuring.

The second part deals with integrated control. Intelligent control of the house is necessary to reduce energy consumption and increase comfort levels, making maximum use of the windows as sources of light and ventilation openings. To learn more about the benefits of intelligent control, VELFAC and the VELUX Group have joined forces with The Engineering College of Aarhus and the Alexandra Institute, using Home for Life as a case study. The cooperation has developed into a research project called Minimum Configuration – Home Automation. The objective of the project is to develop and collate ideas for how cordless operation can be useful and relevant to users by testing various strategies for intelligent automatic operation in the house with user input.

The ultimate hope is that the project will give a family full control of the automatic management of light, heat and energy in their homes and provide comprehensive consumption data.



The Simonsen family moved into Home for Life on 1 July 2009.

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