

# Solhuset – Lions Active House



Solhuset is the most climate friendly daycare centre in Denmark. It is a unique building, self-sufficient with energy, and built as an Active House. This makes Solhuset very interesting not least for professionals within climate, energy and environment.

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Architect:	Christensen & CO Arkitekter
Photographer:	Adam Mørk
Client/investor:	Hørsholm Kommune, VKR Holding A/S and Lions Børnehuse
City:	Hørsholm
Country:	Denmark
Year of completion:	2011





In February 2011, the integrated childcare centre Solhuset in Hørsholm opened its doors to nearly 100 children and 30 adults. They now enjoy everyday life in a healthy environment with plenty of daylight and fresh air.



Site plan

#### Aim and vision

Childcare centres and schools have a particular need for a good and healthy indoor climate as it strengthens well-being and learning capacity as well as reduces the risk of diseases.

The vision for Solhuset (The Sunhouse) was to set new standards for future sustainable childcare centres. It rests on the Active House principles of buildings that give more than they take – to the children, adults, environment, and surroundings. Solhuset is showing the way; it has the framework for a healthy indoor climate where children learn to live in harmony with nature and without negative impact on the environment.



Daylight and a healthy indoor climate play a vital role in Solhuset.

From the very beginning, the vision was to create a building with a positive impact on its surrounding environment and daily users.

Solhuset was developed in a strategic partnership between Hørsholm Municipality, VKR Holding A/S and Lions Børnehuse, and built by Hellerup Byg A/S in co-operation with Christensen & CO

arkitekter a/s and Rambøll A/S.

VELUX A/S, VELFAC A/S, SONNENKRAFT, WindowMaster A/S and SUPERWOOD A/S supplied the materials: roof and facade windows, solar thermal and geothermal heat systems, intelligent control system, natural and mechanical ventilation, and cladding.

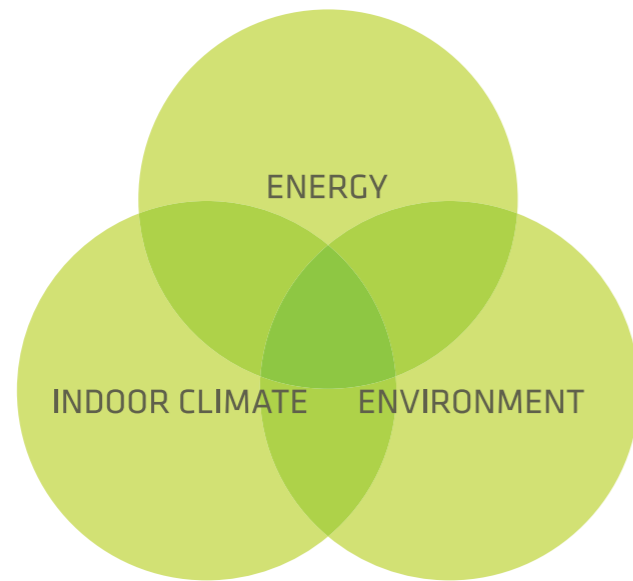
The partners want Solhuset to be a vision for future childcare centres, where

children learn to live in interaction with nature without having a negative impact on the environment.

Solhuset shows the path to buildings of the future by:

- contributing to reducing the use of fossil fuels,
- providing a healthy and comfortable indoor climate,
- contributing positively to the environment and its surroundings.





**Active House**  
Solhuset was designed and built according to the Active House principles – a vision of buildings that give more than they take by creating healthy and comfortable lives for their occupants with no negative impact on the environment.

**What is an Active House?**  
The Active House principles set the framework for design and renovation of buildings that contribute positively to human health and well-being by focusing on indoor and outdoor environments and renewable energy.

Such buildings are evaluated by the interaction between three parameters:

- **Environment:** an Active House interacts positively with the environment through an optimised relationship with its local context, conscious use of resources, and overall environmental impact throughout its life cycle.
- **Indoor climate:** an Active House creates healthier and more comfortable indoor conditions for its occupants and ensures a generous supply of daylight and fresh

air. The materials used have a positive impact on comfort and indoor climate.

- **Energy:** an Active House is energy-efficient and all energy needed is supplied by renewable energy sources integrated in the building or by the nearby collective energy system and electricity grid.

For more information on Active House: [www.activehouse.info](http://www.activehouse.info).



1. Main entrance
2. Open-air shelter
3. Common rooms
4. Service rooms
5. Wardrobe for wet clothes
6. Lavatory with access from the outdoor area
7. Covered exit areas
8. Lavatories
9. Group rooms
10. Staff facilities
11. Greenhouse

**An Active House for children**

The new childcare centre Solhuset is an exciting, lively, and bright building, where both children and adults feel at ease.

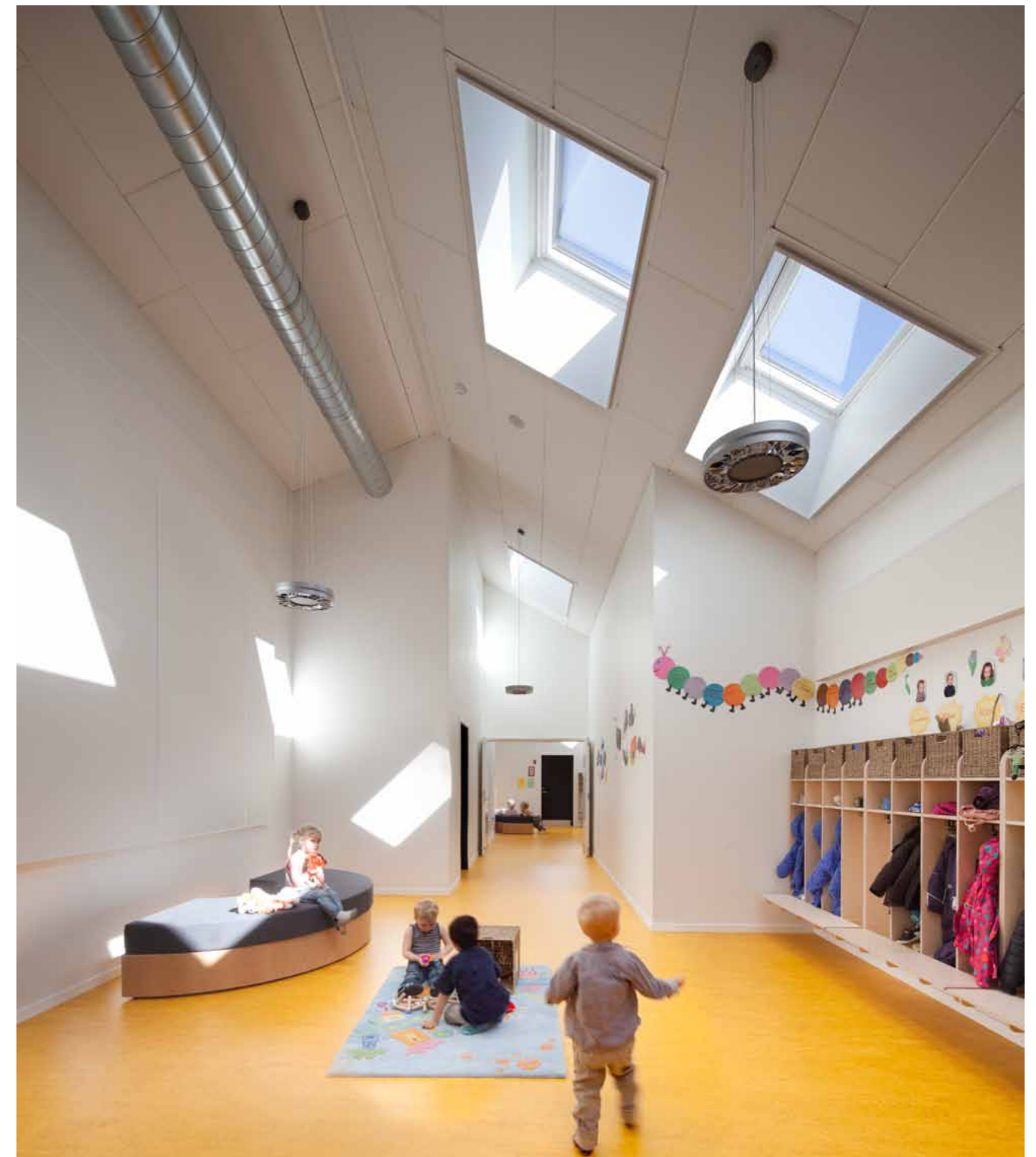
**Layout**

Solhuset is laid out as a small village with streets, lanes, small squares and niches, and is divided into three zones: an arrival zone; a small children's zone with access to group rooms, an outdoor area and an open-air shelter; and a large children's zone with access to group rooms and the outdoor area. Common exercise rooms and eating facilities are placed in the middle of the house for easy access.

**Indoor climate**

Solhuset has a healthy and comfortable indoor climate with plenty of daylight and fresh air.

It has high-ceilinged rooms and strategically-placed windows to ensure optimum use of daylight. The sloping roof, with roof windows that open and close automatically, creates varied ceiling heights for good air circulation in the rooms.



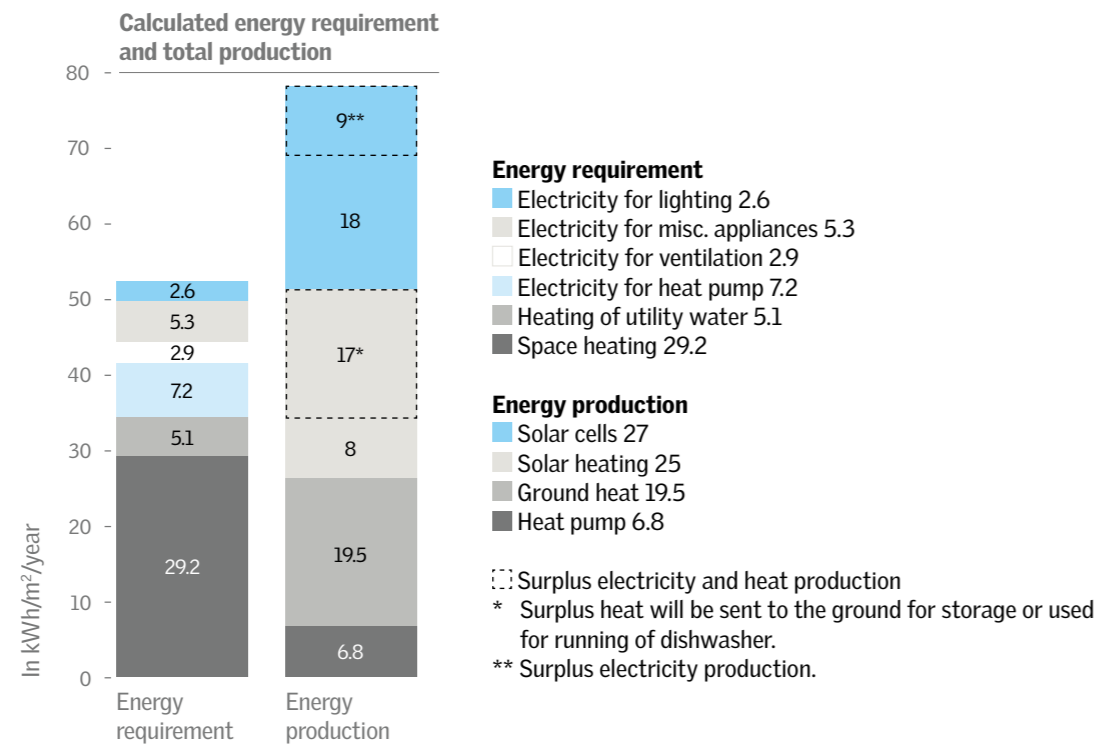
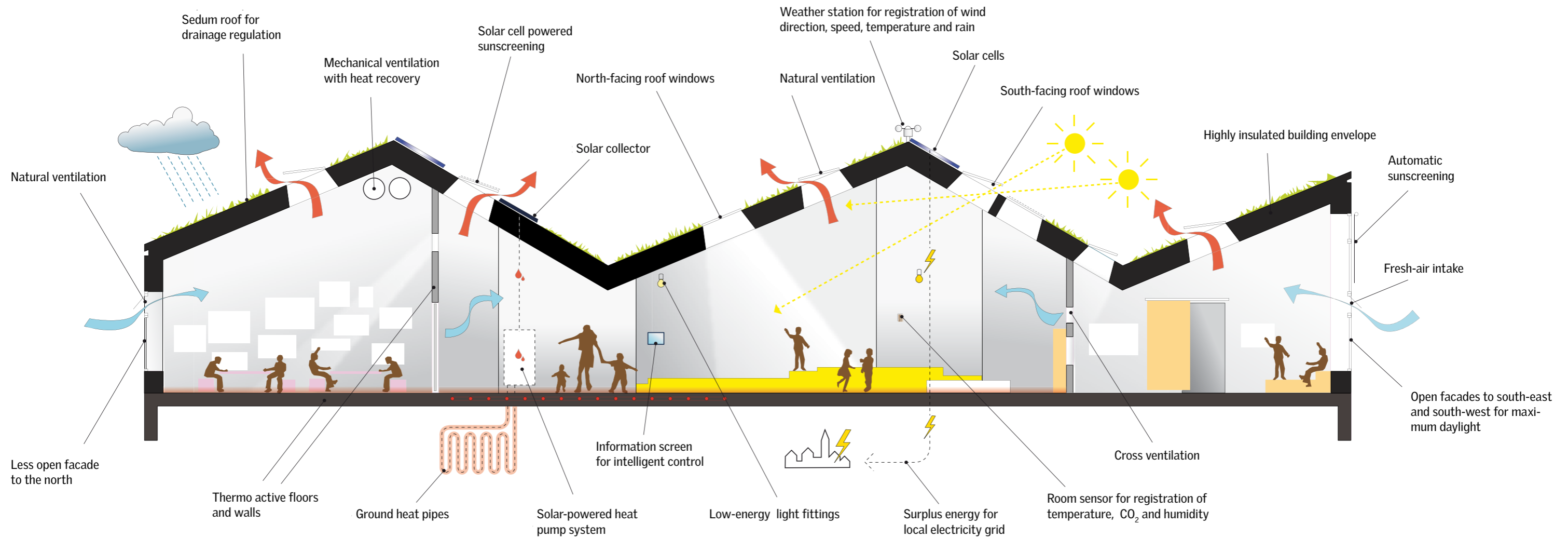
Intelligently controlled sun screening and window opening make the house flexible, allowing the flow of daylight and fresh air to adapt continuously to the weather conditions outside and the needs indoors. Solhuset is built of sound materials that have minimal impact on the indoor climate. Vertical windows in the south-east and south-west facades and roof windows let in more than three times as much light as in a traditional house.

A weather station on the roof, together with temperature and CO<sub>2</sub> sensors in

every room, ensures a good indoor climate – protecting against superheating, ventilating with fresh air, and switching the lights on and off according to needs and weather conditions – and saves energy.

- An average daylight factor of 7% in living rooms and up to 4% in the innermost part of the rooms – even with a window area of only 28% of the floor area.
- All rooms get daylight from at least two sides.
- Vertical windows with iron-free glass ensure that up to 85% of the light is

- transmitted through the windows.
- Plenty of fresh air is ensured by a combination of automatically controlled natural and mechanical ventilation with heat recovery (hybrid ventilation).
- Strategically-placed windows ensure optimal use of daylight and adequate air flow.
- The special design and volume of the rooms, together with the use of sound absorbers, ensure a good acoustic climate.
- Use of healthy materials ensures minimal impact on the indoor climate.



### Energy

Solhuset uses renewable energy sources and was designed to produce more energy than it consumes.

The design, orientation, construction materials, windows and the intelligent control of the indoor climate ensure an energy consumption rated as energy class 1, equivalent to the requirements of the Danish Building Regulations 2015 – even without including the energy produced by the renewable energy technologies in the house.

The sun supplies Solhuset with heat through the roof and facade windows. The windows contribute half the heat needed in wintertime. The remaining requirement for space heating and hot water is produced by a combined solar and geothermal system. Strategically placed on the south-facing roof, 50 m<sup>2</sup>

solar collectors harvest energy directly from the sun and convert it into heat and hot water, while 250 m<sup>2</sup> solar cells convert solar energy into electricity. Solhuset was designed to produce 9 kilowatt-hours per m<sup>2</sup>/year more than it is expected to consume.

The surplus energy production means that in about 40 years the centre will have paid back the CO<sub>2</sub> emitted during production of its primary building materials. That makes Solhuset CO<sub>2</sub> neutral throughout its lifetime.

Solhuset is designed to:

- be CO<sub>2</sub> neutral and self-sufficient in energy,
- meet the requirements of Danish energy class 1 (51 kWh/m<sup>2</sup>/year) even before the use of renewable energy,
- produce 9 kWh/m<sup>2</sup>/year of surplus energy.

Energy for Solhuset is produced by the 50 m<sup>2</sup> solar collectors, 1000 m geothermal pipes, and 250 m<sup>2</sup> solar cells (34 kW).

This meets the operational needs of the building, the control systems and the appliances.



## Facts about Solhuset

- Solhuset is an integrated childcare centre with room for about 100 children and 30 employees.
- The childcare centre is built in Hørsholm, 30 km north of Copenhagen.
- Floorage: 1,300 m<sup>2</sup>.
- Solhuset was built to the Active House principles of buildings that give more than they take. An Active House has low energy consumption, a healthy indoor climate, contributes positively to the surroundings and does not harm the environment.
- The childcare centre has a healthy indoor climate with fresh air and 3.5 times more daylight than required by current building regulations.
- The childcare centre is CO<sub>2</sub> neutral and self-sufficient in energy through passive solar gain from windows, solar collectors, solar cells and geothermal pipes.
- The building was designed to meet the requirements of Danish energy class 1 (51 kWh/m<sup>2</sup>/year) before the use of renewable energy sources.
- All rooms receive daylight from at least two sides.
- Natural ventilation, supplemented by mechanical ventilation and automatic sun screening, ensures a comfortable indoor climate.

For more information on Solhuset, visit:

[www.activehouse.info/solhuset](http://www.activehouse.info/solhuset) and  
[www.horsholm.dk/solhuset](http://www.horsholm.dk/solhuset)

## Environment

Solhuset contributes positively to its surroundings and interacts with nature. The childcare centre is an open and transparent building with seamless transitions between functions and between outdoors and indoors. It was designed, located, and constructed to let in nature and create closeness between indoors and outdoors.

The shape, orientation and windows are optimised in relation to the plot as well as the sun in order to make maximum use of daylight and solar heat throughout the day and the year. Solhuset is triangular,

like the plot it is built on, and the roof surfaces face north and south. The south-facing surfaces are steeper than those facing north to obtain the optimal angle to harvest solar energy.

Healthy and sustainable materials have been chosen for the building. The facades, for instance, are clad with wood impregnated without the use of heavy metals and solvents. Between the solar thermal collectors and solar cells, the roofing is organic green sedum material that absorbs rainwater.

- All materials are healthy and sustainable throughout their entire lifecycle, from production and construction to subsequent use, maintenance and disposal.
- Recyclable materials have been used; surfaces, paints and so on all bear the Nordic Ecolabel or the Danish Indoor Climate Label.
- Solhuset produces more energy than it consumes. Over a period of 40 years, the surplus energy will repay the CO<sub>2</sub> emitted during production of the primary building materials; this makes the building CO<sub>2</sub> neutral.