

# CarbonLight Homes

**VELUX®**

MODEL HOME 2020





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**Photos of CarbonLight Homes**  
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**Illustrations of CarbonLight Homes**  
HTA Architects and Cenario

**Other photos and illustrations**  
The VELUX Group



CarbonLight Homes are two semi-detached homes. They are proof that it is possible to build energy efficient, sustainable housing that is not only pleasant to live in, but also easy to replicate by the volume house builder. These homes are designed and built to the UK government definition of zero carbon and will achieve Level 4 of the Code for Sustainable Homes.

The design of these properties intends to minimise energy use among residents and generate a sense of community, while advocating a respect for the environment. The aesthetics of the scheme are sympathetic to the local context while also retaining an identity of its own.

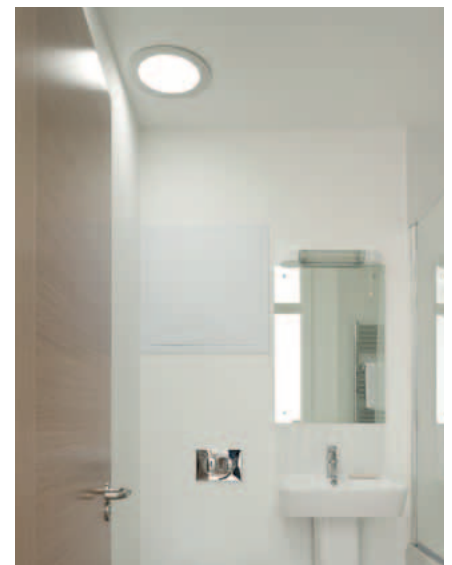


### **The architectural design**

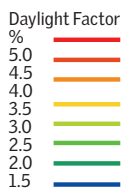
CarbonLight Homes are designed by HTA architects. The design is original with the use of building technology and the exciting way it captures natural daylight and ventilation to minimise energy consumption.

### **Daylight**

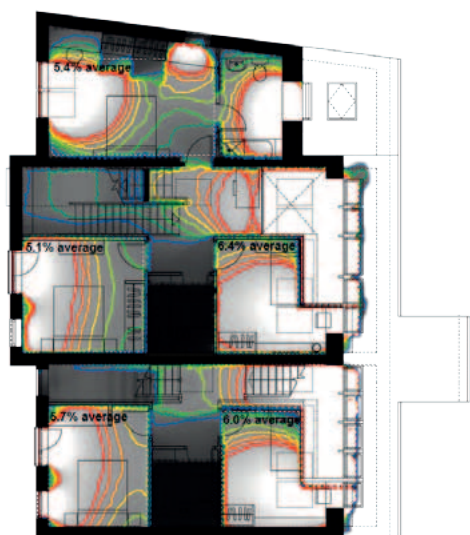
The starting point was to maximise daylight, which has many health and well-being benefits. Through extensive modelling HTA have achieved designs with a minimum average daylight factor of 5% for the whole house – which is up to three times greater than that required by the Code for Sustainable Homes in living spaces.



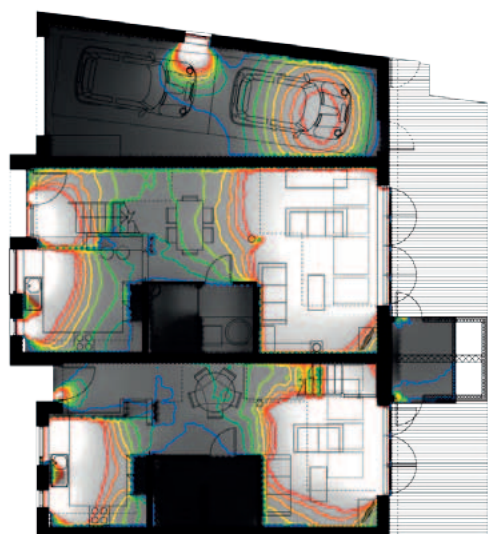
## Daylight levels



### Second floor



### First floor



### Ground floor

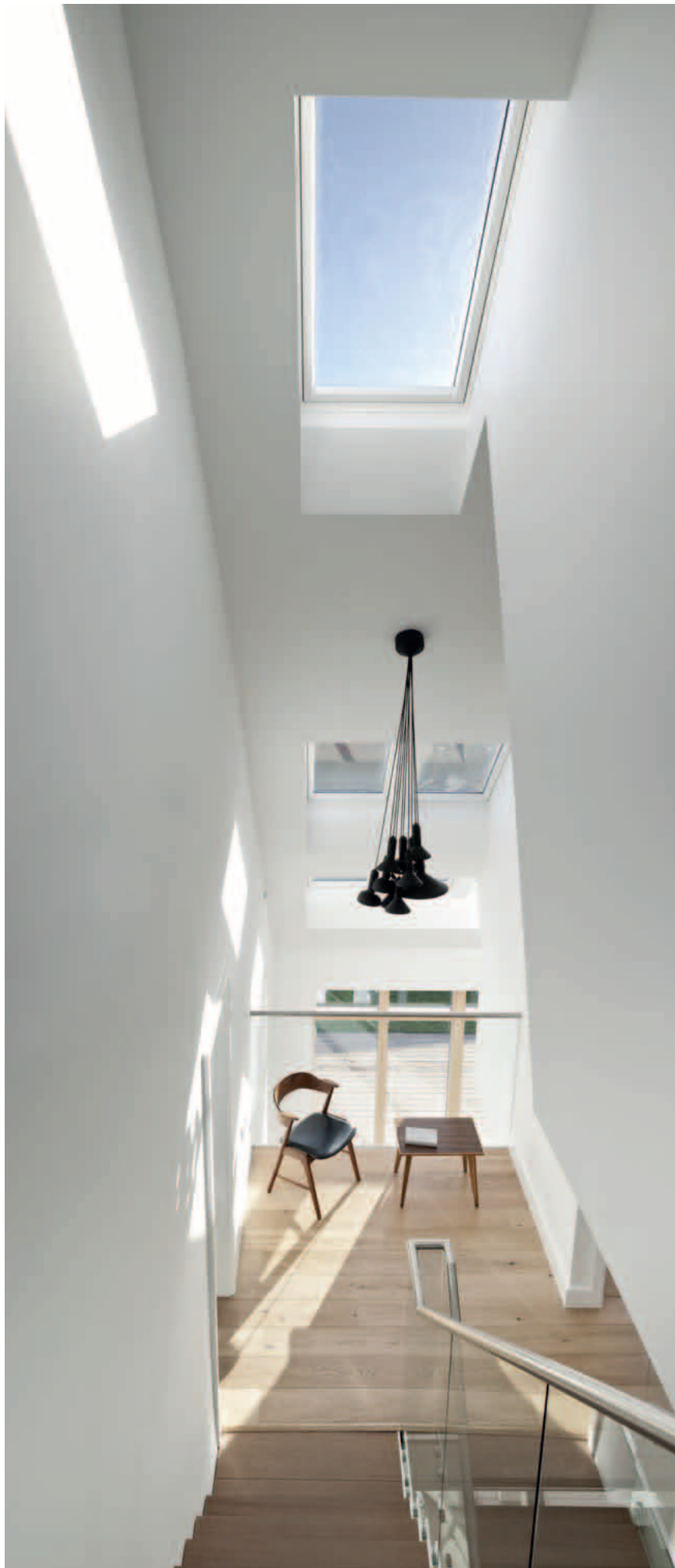
## Prizes and mentions

### Design of future sustainable homes

The two zero carbon homes were selected for the accolade by a panel of industry experts. The judges commended the VELUX scheme for its original use of building technology and the exciting way it captures natural daylight and ventilation to minimise energy consumption. The properties were hailed as an exemplary benchmark for the design of future sustainable homes.

### Winner of the Innovation Award

CarbonLight Homes emerged as the winner of the Innovation Award for Building Technology at the prestigious British Homes Awards (BHA) 2010.



## Energy design

The homes will achieve a 70 % reduction in CO<sub>2</sub> emissions, with the remaining 30 % of emissions being offset through an 'allowable solution'. The offsetting will be achieved in agreement with the Local Government office by carrying out improvements to the energy efficiency of existing local housing, which will more than offset the remaining emissions from the CarbonLight Homes, thus surpassing the required 100 % reduction in CO<sub>2</sub> emissions for the project.

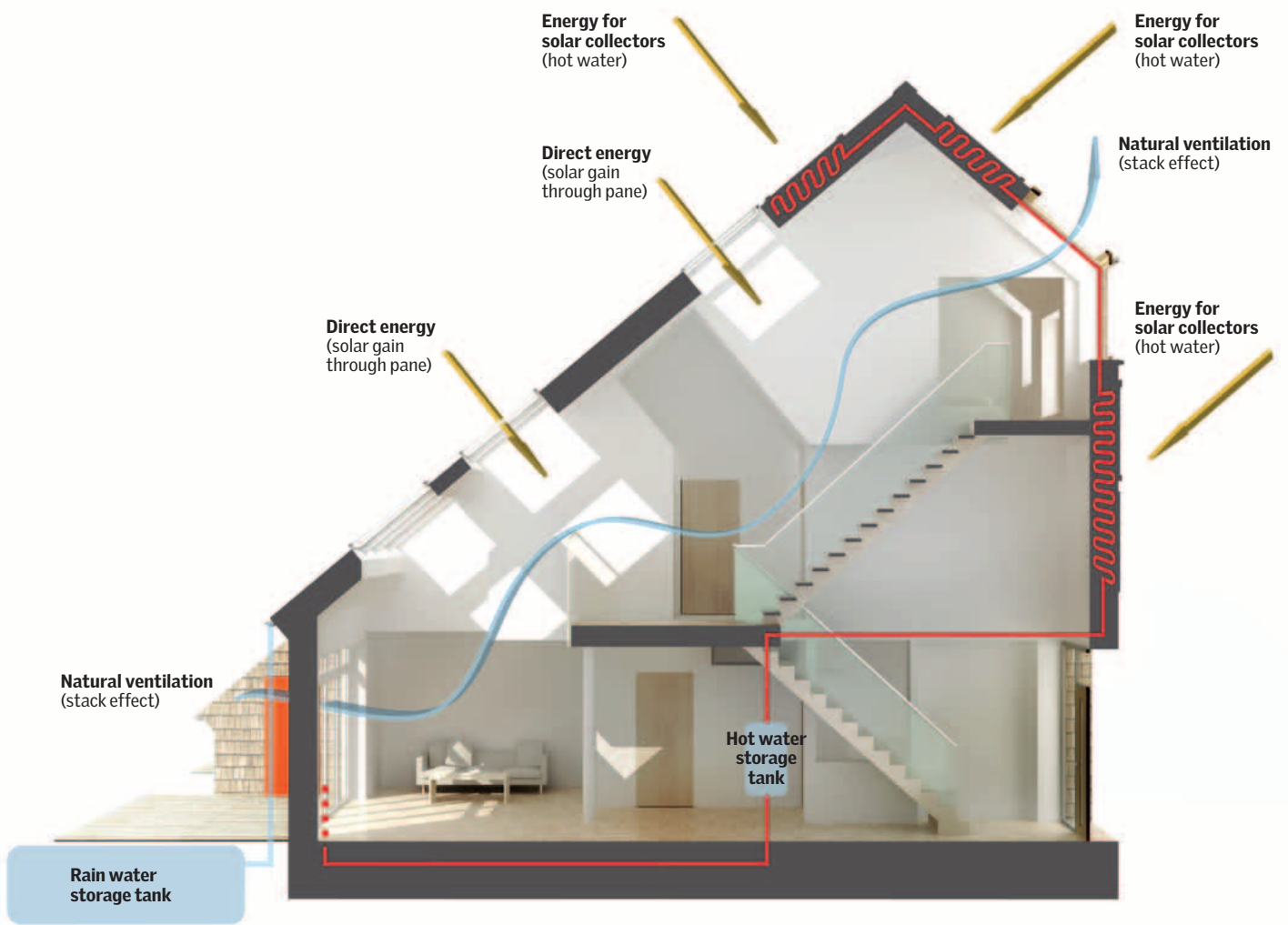
### Ventilation and heating

The houses are designed in such a way that fossil fuel energy (such as electricity), is reduced to a minimum. In the summer, natural ventilation is used for cooling and to create air movement that will push stale air out as well as bring fresh air in and maintain good levels of thermal comfort. During the winter, a Mechanical Ventilation system with Heat Recovery is used in addition to the natural ventilation system. This 'MVHR' system will extract heat from the kitchen and bathrooms and recycle it into the home to reduce the demand on the space heating system.

- Solar heating in combination with an air-to-water heat pump produces thermal energy that is used for hot water and space heating.
- Natural ventilation, as well as internal and external sun screening, ensures fresh air and a comfortable room temperature. Triple-height atriums around the stairs allow natural ventilation through both stack and cross ventilation. In the summer the homes can be opened up and cooled through massive purge ventilation.
- The control systems for the houses reduce energy consumption and ensure a healthy indoor climate.

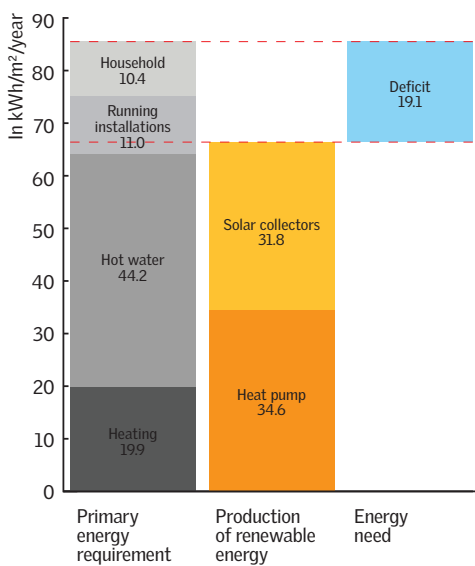
### Testing and monitoring

Unlike similar Eco building projects in the UK, the CarbonLight Homes are not prototypes to be showcased and monitored for an extended period of time, but designed to be real homes for real people. The testing and monitoring of the CarbonLight Homes will be part of a VELUX initiative where all six of the Model Home projects around Europe will provide data to be collated, reviewed and reported. Therefore, the energy consumption and performance of the buildings will be monitored for a twelve month period with test families in residence and afterwards the houses will be offered for sale on the open market.



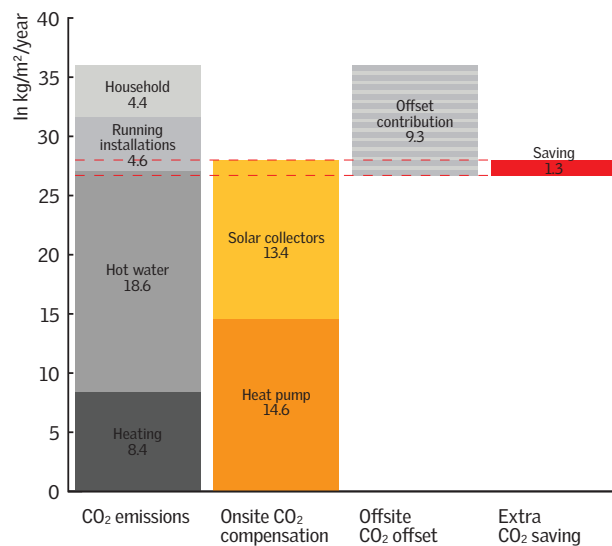
The calculation of the energy performance and production has been made according to national standards.

### Net energy balance

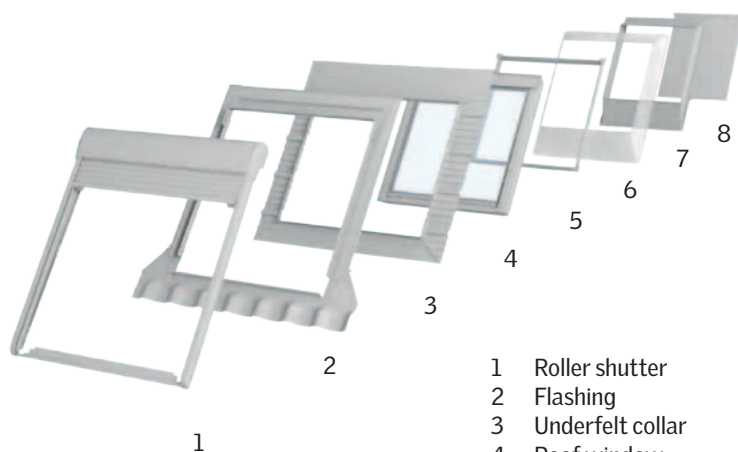
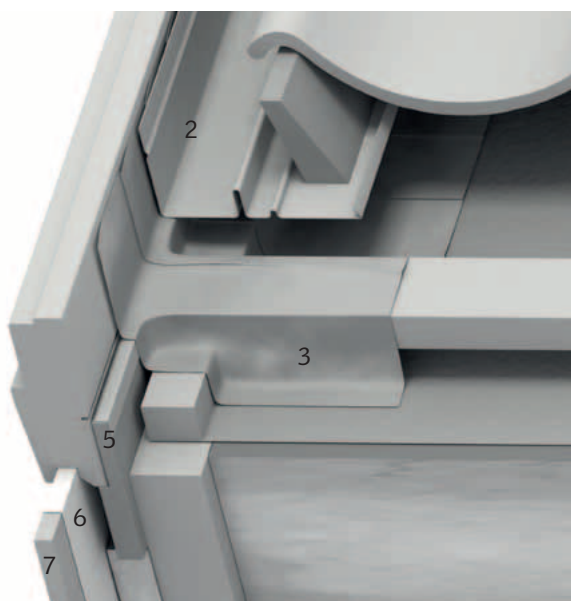


The calculation of the energy performance and production has been made according to national standards.

### CO<sub>2</sub> balance



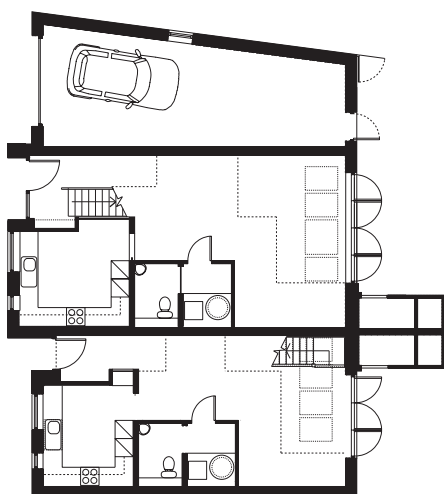
## System solution



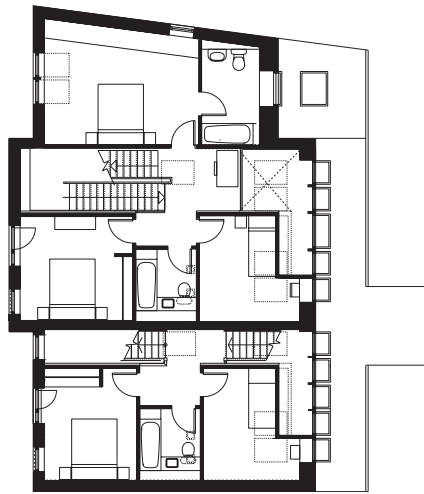
- 1 Roller shutter
- 2 Flashing
- 3 Underfelt collar
- 4 Roof window
- 5 Insulation collar
- 6 Vapour barrier
- 7 Lining
- 8 Interior suncreening



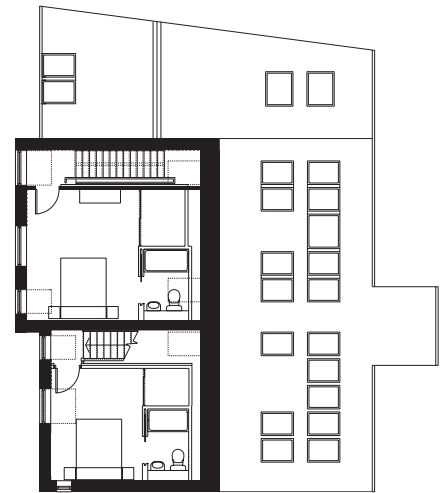




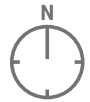
Ground floor



First floor



Second floor



### 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/m <sup>2</sup> K	1.1 W/m <sup>2</sup> K	1.1 W/m <sup>2</sup> K
$U_g$ (Heat loss U-value pane)	0.5 W/m <sup>2</sup> K	0.7 W/m <sup>2</sup> K	0.6 W/m <sup>2</sup> K
g (Heat gain g-value)	0.46	0.46	0.46
Tau (Light transmittance)	0.67	0.67	0.67

### Outer walls

U (Heat loss U-value)	0.11 W/m <sup>2</sup> K (130 mm insulation)
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### Roof

U (Heat loss U-value)	0.11 W/m <sup>2</sup> K (205 mm insulation)
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### Floor slab

U (Heat loss U-value)	0.11 W/m <sup>2</sup> K (250 mm insulation)
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### Fenestration

Glass area	56 m <sup>2</sup>
Net floor area	230 m <sup>2</sup>

The glass area is equivalent to 24.5 % of the net floor area.

# Experiment # 5

## Bedroom 1 en-suite

- 1 triple glazed, centre-pivot, polyurethane finish, solar powered roof window (GGU M08 0065G30R) + installation products BBX, BDX and EFL

## Over stairs rear

- 1 triple glazed, centre-pivot, polyurethane finish, solar powered roof window (GGU M08 0065G30R) + installation products BBX, BDX and EFL
- 1 solar powered awning blind (MSL M08 5060E)

## Bedroom 3

- 2 triple glazed, centre-pivot, polyurethane finish, solar powered roof windows (GGU M08 0065G30R)
- 1 triple glazed, top hung, polyurethane finish, manual roof window (GPU M08 0065G) + installation products BBX, BDX, EKL and EKY
- 2 solar powered roller shutters (SSL M08 0000E)
- 1 solar powered awning blind (MSL M08 5060E)
- 3 solar powered blackout blinds (DSL M08 1025E)

## Over living area

- 5 triple glazed, centre-pivot, polyurethane finish, solar powered roof windows (GGU M08 0065G30R) + installation products BBX, BDX, EDL, EKL and EKY
- 5 solar powered awning blinds (MSL M08 5060E)

## Bedroom 1

- 1 double glazed, centre-pivot, pine finish, solar powered roof window (GGL S06 3073G30R)
- 1 double glazed, side hung, pine finish, manual vertical window (VFA S38 3073G) + installation products BBX, BDX and EFL
- 1 solar powered awning blind (MSL S06 5060E)
- 2 solar powered blackout blind (DSL S06 + S08 1025E)

## Over living area

- 6 triple glazed, centre-pivot, polyurethane finish, solar powered roof windows (GGU M08 + S08 0065G30R) + installation products BBX, BDX, EKL and EKY
- 6 solar powered awning blinds (MSL M08 + S08 5060E)

## Over stairs front

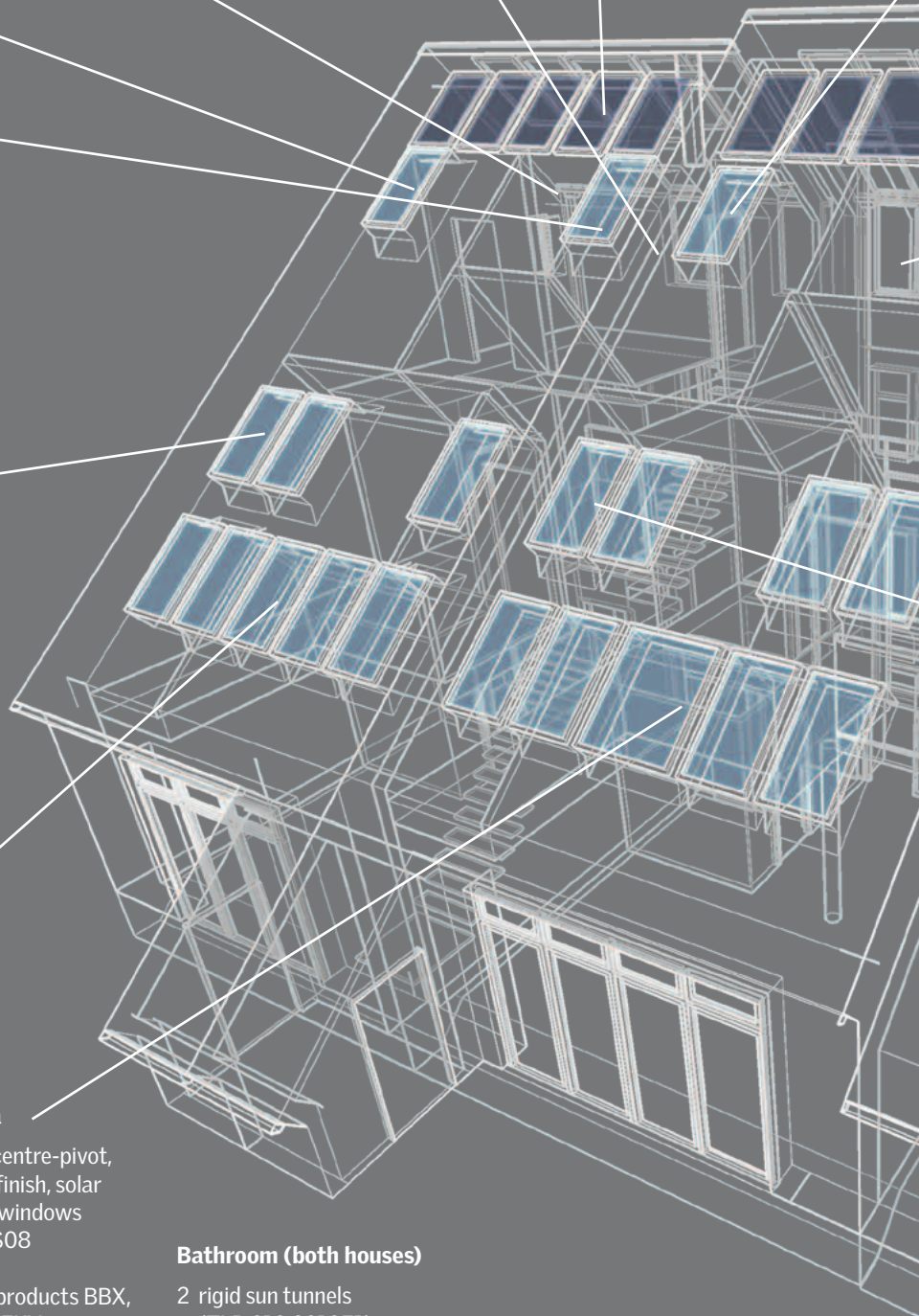
- 1 double glazed, centre-pivot, pine finish, solar powered roof window (GGL M06 3073G30R)
- 1 double glazed, side hung, pine finish, manual vertical window (VFB M38 3073G) + installation products BBX, BDX and EFL
- 1 solar powered awning blind (MSL M06 5060E)
- 2 solar powered blackout blinds (DSL M06 + M08 1025E)

## Bathroom (both houses)

- 2 rigid sun tunnels (TLR 010 2010E1) + ZTR rigid extension piece and ZTL light kit

## Thermal solar energy

- 10 flat plate solar collectors (CLI M08 + S08 4000) + installation products EFL



### Master en-suite

- 1 triple glazed, centre-pivot, polyurethane finish, solar powered roof window (GGU M08 0065G30R) + installation products BBX, BDX and EFL

### Thermal solar energy

- 12 flat plate solar collectors (CLI M08 + S08 4000) + installation products EFL

### Over stairs rear

- 1 triple glazed, centre-pivot, polyurethane finish, solar powered roof window (GGU M08 0065G30R) + installation products BBX, BDX and EFL
- 1 solar powered awning blind (MSL M08 5060E)

### Master bedroom

- 1 double glazed, centre-pivot, pine finish, solar powered roof window (GGL M08 3073G30R)
- 1 double glazed, side hung, pine finish, manual vertical window (VFA S38 3073G) + installation products BBX, BDX and EFL
- 1 solar powered awning blind (MSL M08 5060E)
- 1 solar powered blackout blind (DSL M08 1025E)

### Over stairs front

- 1 double glazed, centre-pivot, pine finish, solar powered roof window (GGL S08 3073G30R)
- 1 double glazed, side hung, pine finish, manual vertical window (VFB S38 3073G) + installation products BBX, BDX and EFL
- 1 solar powered awning blind (MSL S08 5060E)
- 1 solar powered blackout blind (DSL S08 1025E)

### Guest suite

- 2 double glazed, centre-pivot, pine finish, solar powered roof windows (GGL M08 3073G30R)
- 4 double glazed, bottom hung, pine finish, manual vertical windows (VFE M31 + M34 3073G) + installation products BBX, BDX and EFL
- 2 solar powered awning blinds (MSL M08 5060E)
- 6 solar powered blackout blinds (DSL M04 + M08 + M31 1025E)

### Bedroom 3

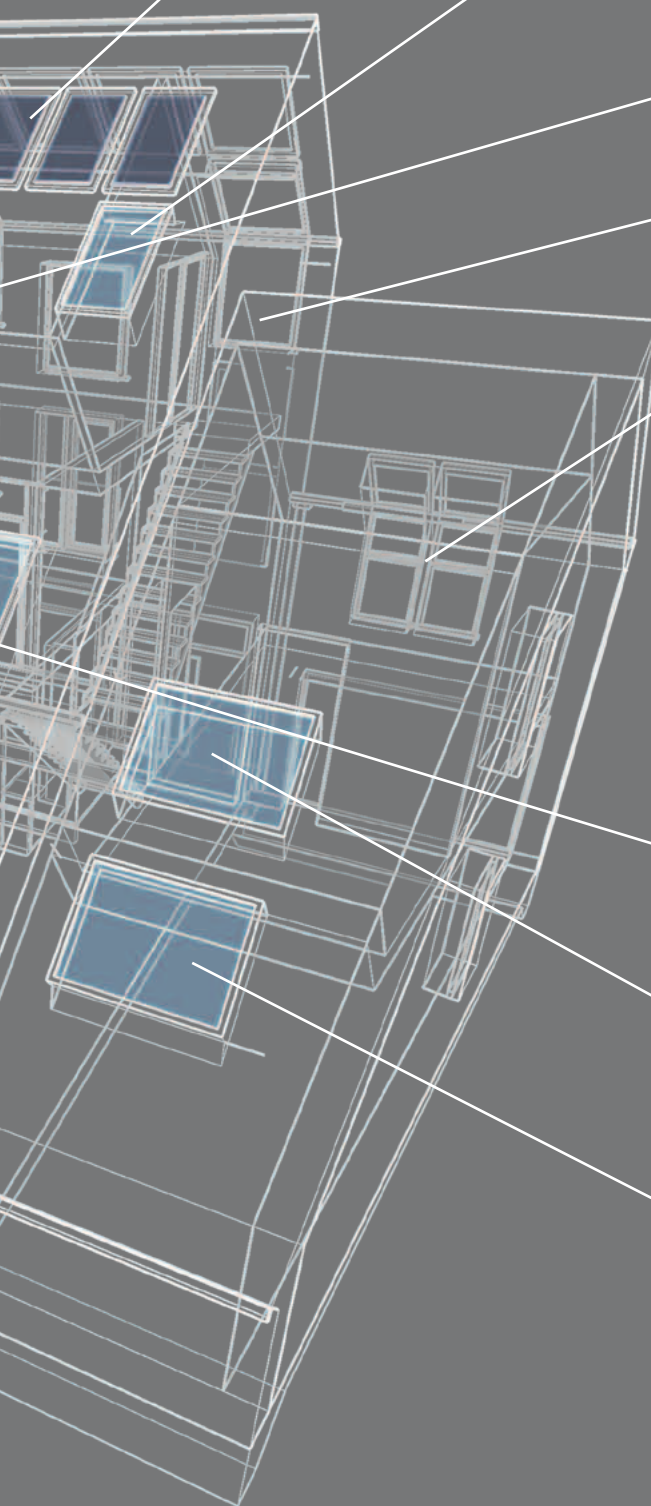
- 2 triple glazed, centre-pivot, polyurethane finish, solar powered roof windows (GGU M08 0065G30R)
- 1 triple glazed, top hung, polyurethane finish, manual roof window (GPU M08 0065G) + installation products BBX, BDX, EKL and EKY
- 2 solar powered roller shutters (SSL M08 0000E)
- 1 solar powered awning blind (MSL M08 5060E)
- 3 solar powered blackout blinds (DSL M08 1025E)

### Garage

- 1 double glazed, centre-pivot, polyurethane finish, manual roof window (GGU S06 0073G) + installation products BBX, BDX and EDL

### Guest en-suite

- 1 triple glazed, centre-pivot, polyurethane finish, solar powered roof window (GGU S06 0065G30R) + installation products BBX, BDX and EFL



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**VELUX®**

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