Conferinta EURO-CONSTRUCTII
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Proiectul E4 pentru Romania – o solutie pentru casa NZEB

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Conceptul de NZEB se refera la o cladire cu o ridicata performanta energetica, in termeni de necesar de energie dar si de utilizare a energiei din combustibili fosili.

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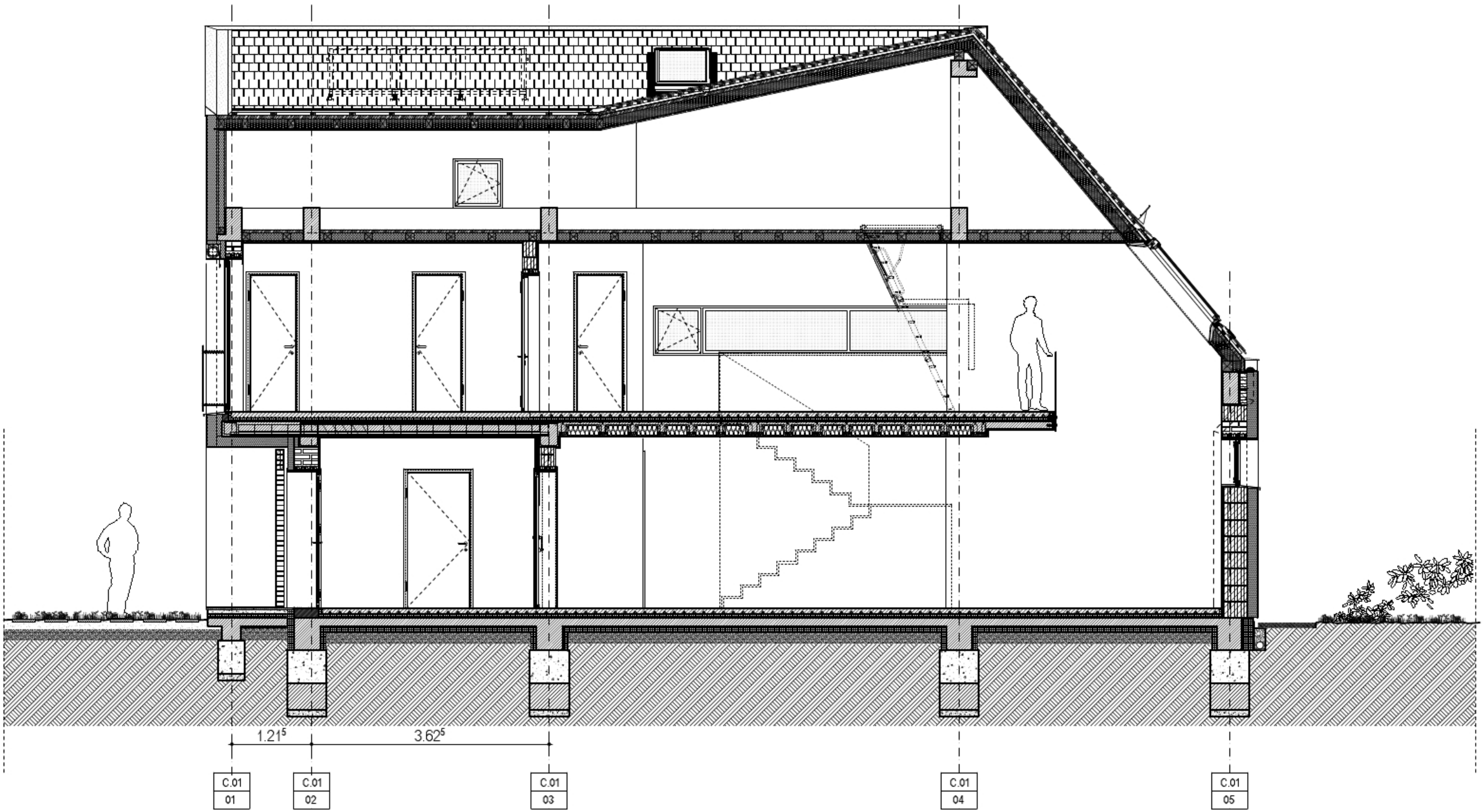
Cantitatea redusa de energie ceruta de asigurarea unui confort la interior corespunzator pe toata durata anului trebuie furnizata in principal din surse regenerabile de energie, prin echipamente amplasate pe cat posibil in cladire sau in imediata apropiere pentru a reduce pierderile la transport si stocaj.

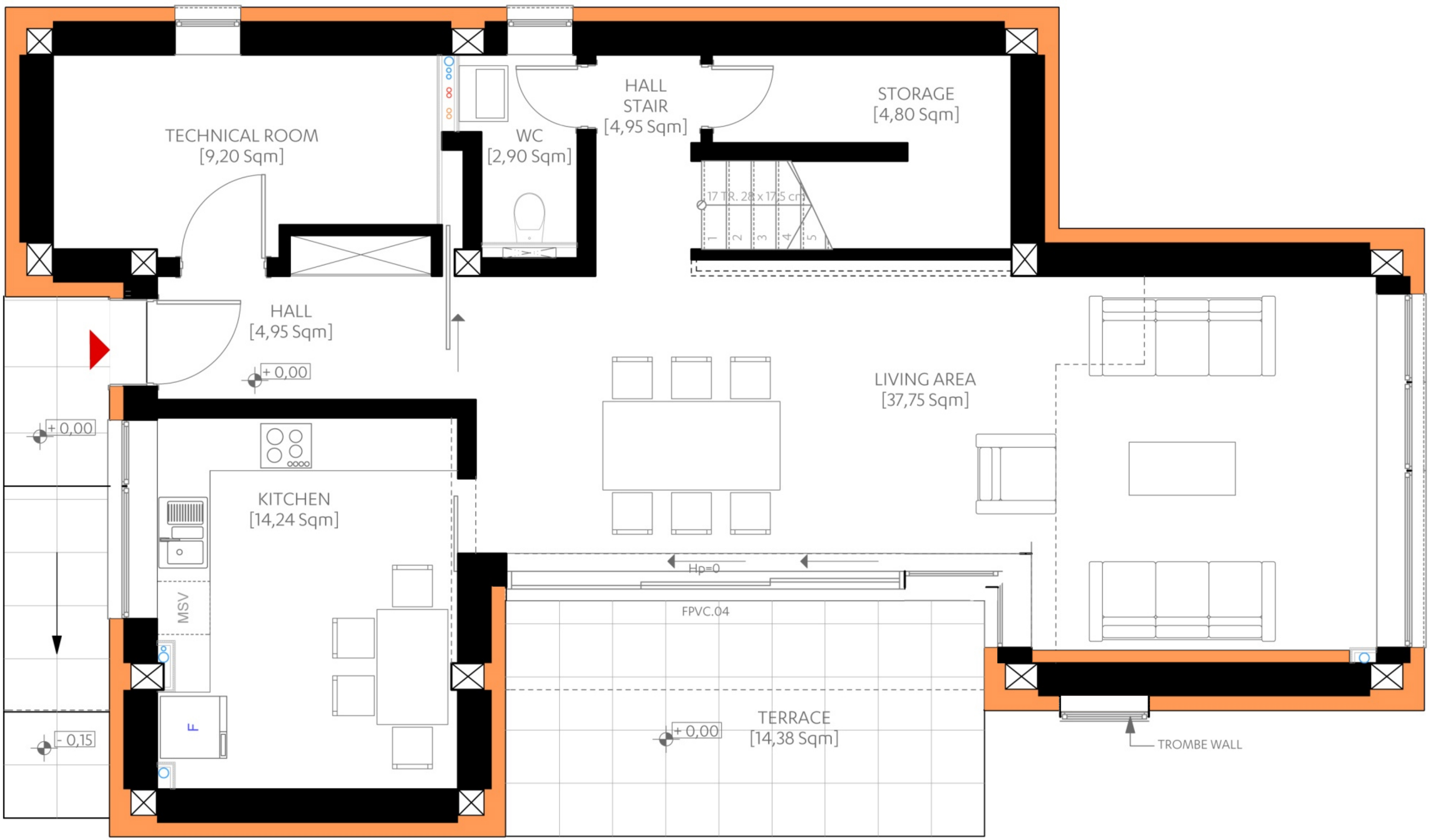
Se prezinta proiectul unei posibile cladiri de tip NZEB bazata pe elemente de ceramica, proiect elaborat in cadrul programului “E4” initiat de firma Wienerberger in Europa.

General External View - South West

View From The Garden - South East



West East Section



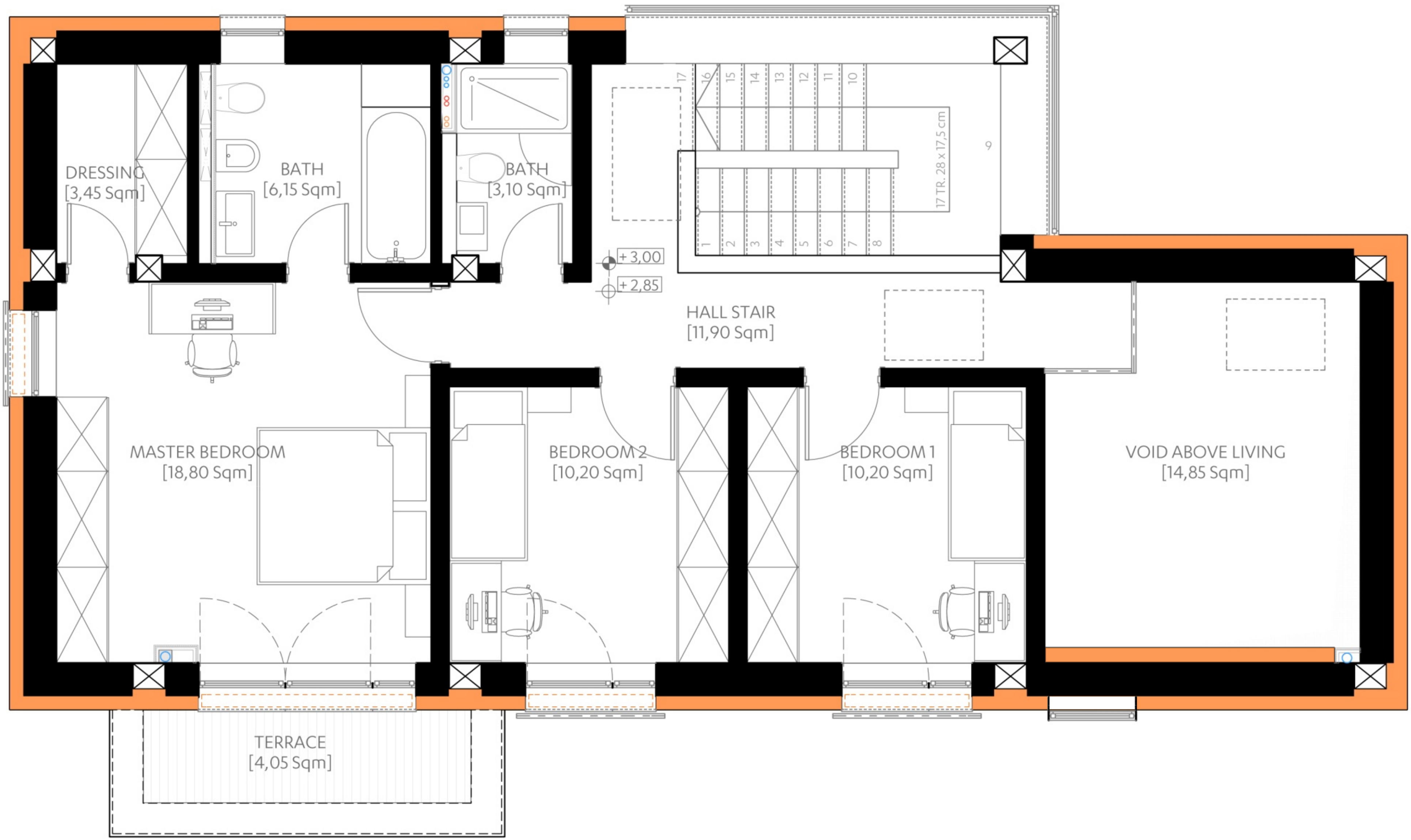
Ground Floor

G:117,25 m^2

\+ F:110,90 m^2

∑228,15 m^2

Total useful area: 140 m^2



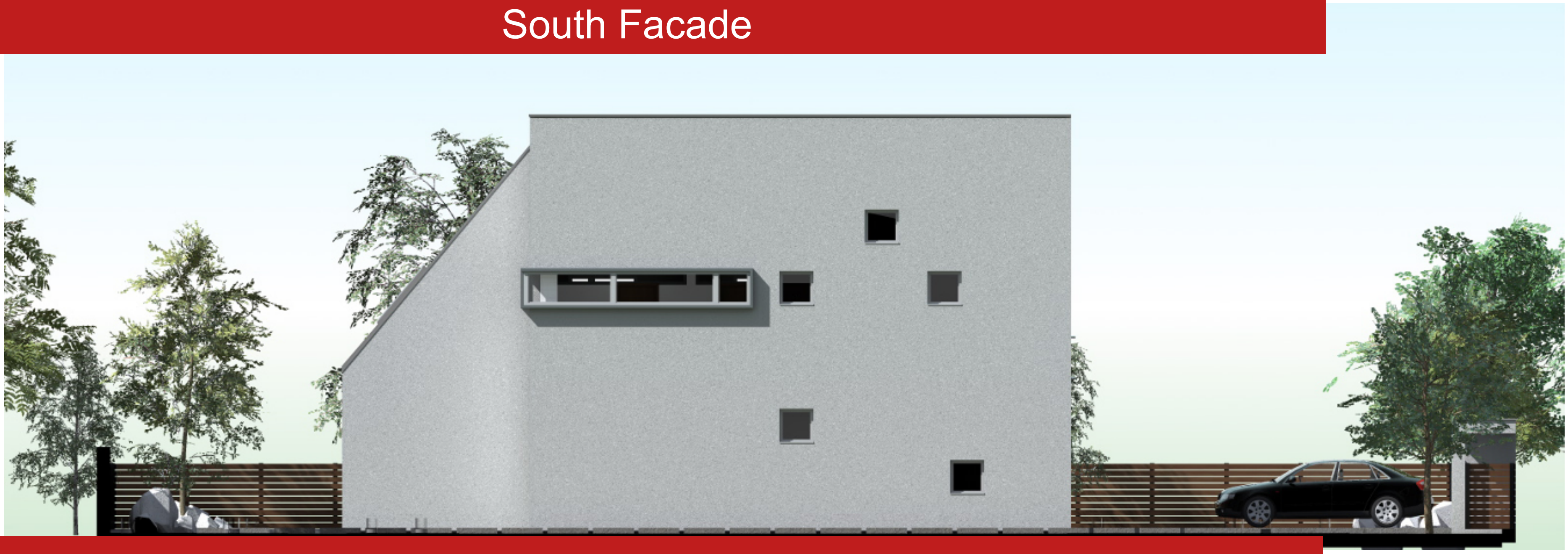
First Floor View

G:117,25 m^2
\+ F:110,90 m^2
∑228,15 m^2

Energy efficiency passive strategies

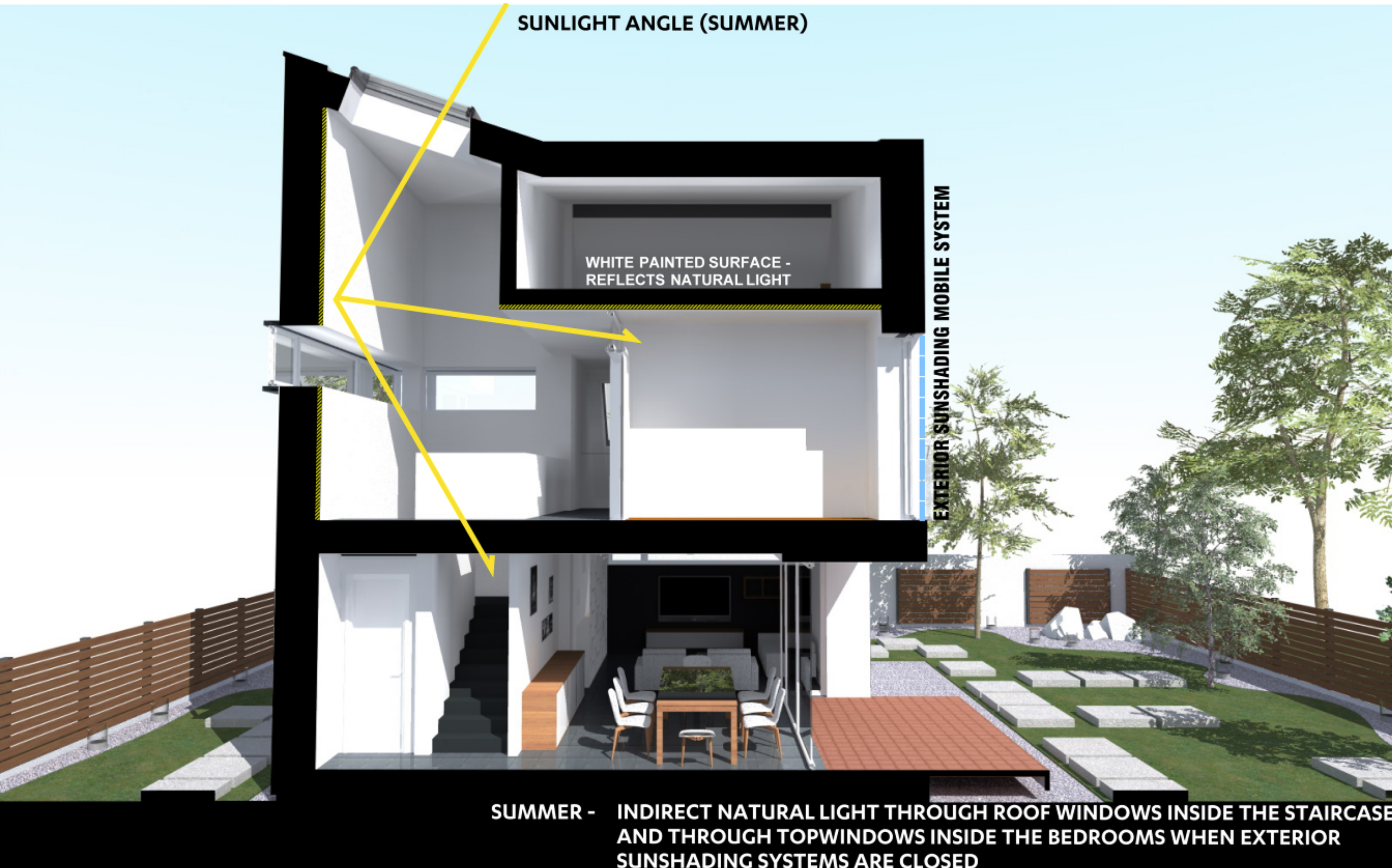
Site Plan

South Facade



North Facade

West – East Perspective - Section



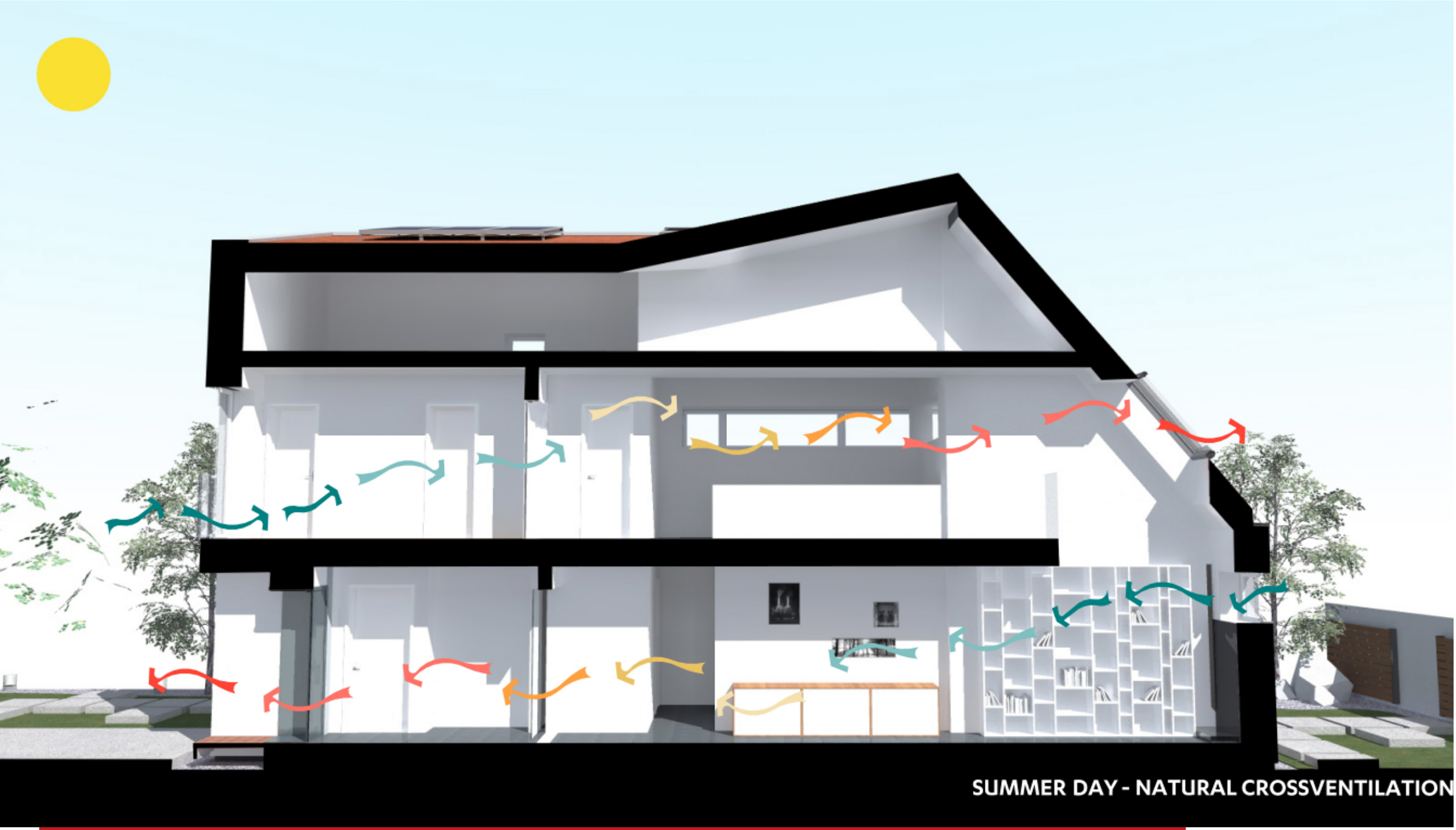
DESIGN STRATEGIES – ENCREASED USE OF NATURAL LIGHT (SUMMER)

DESIGN STRATEGIES – ENCREASED USE OF NATURAL LIGHT (WINTER)

DESIGN STRATEGIES – OVERHEATING PROTECTION (SUMMER)

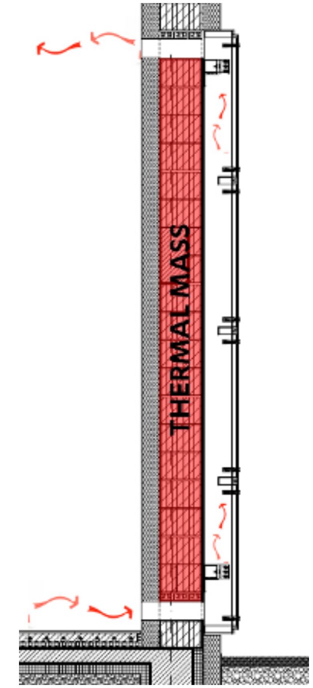
DESIGN STRATEGIES – PASSIVE SOLAR GAIN AND STORAGE (WINTER)

DESIGN STRATEGIES – PASSIVE HEATING USING THERMAL MASS



DESIGN STRATEGIES – NATURAL DAY CROSSVENTILATION

DESIGN STRATEGIES – NATURAL NIGHT CROSSVENTILATION

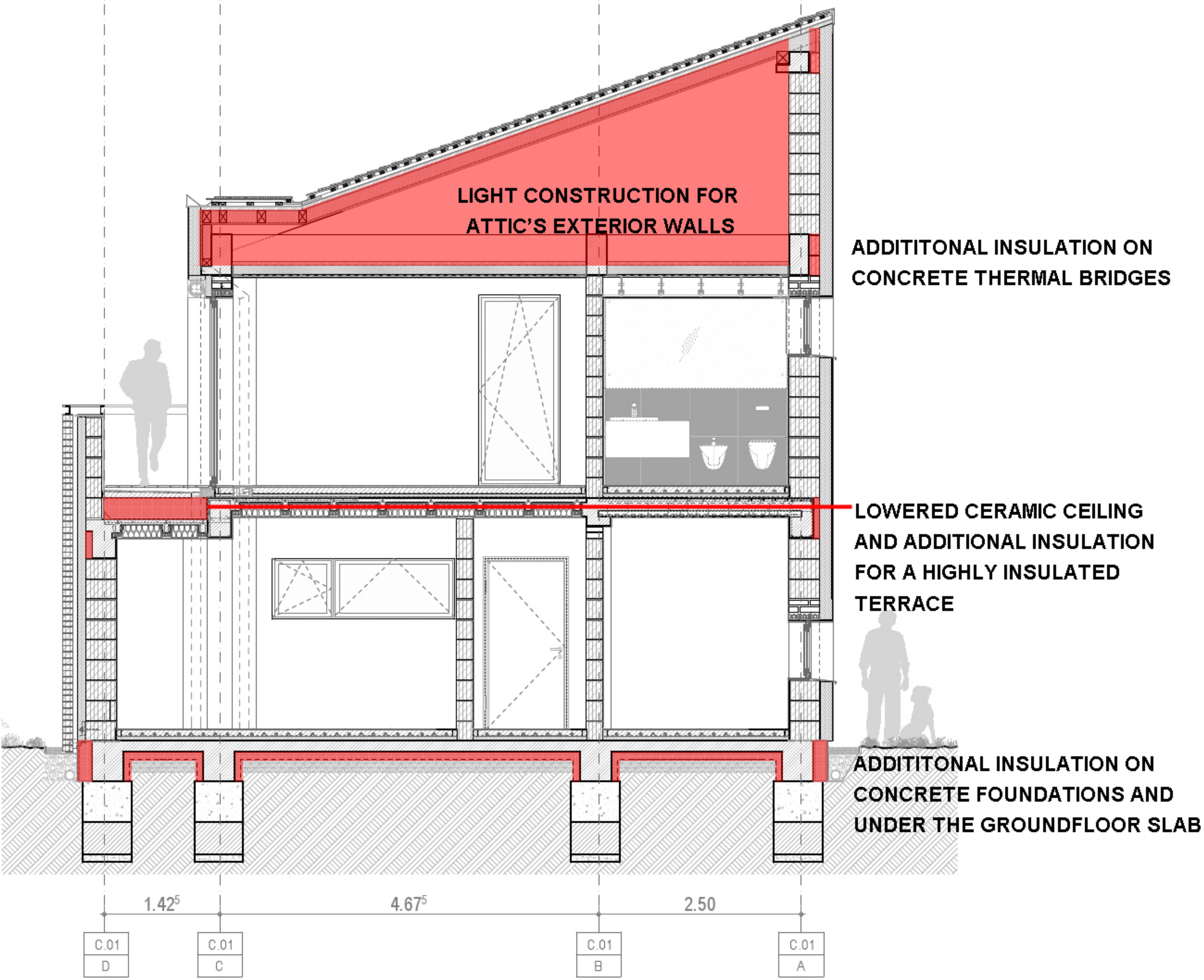


TROMBE WALL – used in winter to heat by greenhouse effect the indoor air..

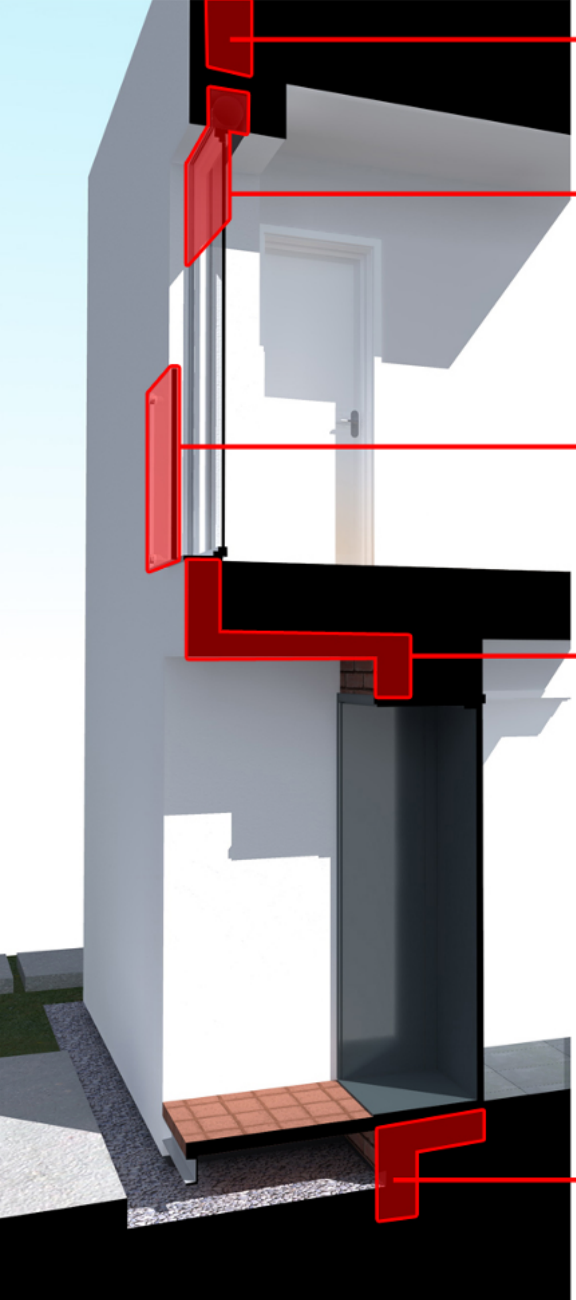
It is composed by a glass panel mounted in an Aluminium frame and placed in front of a Porotherm 38 Sth wall that is plastered and painted black.

Two sensor controlled fans, on bottom and top of the wall assure the air flow from inside through the space in front of the thermal mass and back inside.

TROMBE WALL



Construction Optimization – Thermal Bridges



EXTERIOR WALLS (EXCEPT NORTHERN FAÇADE) OF THE ATTIC ARE MADE OF WOOD AND HIGHLY INSULATED IN ORDER TO REDUCE THERMAL LOSSES.

EXTERIOR SUNSHADING SYSTEM IS RECESSED INSIDE THE MASONRY WALL AND MOUNTED ON POROTHERM LINTELS IN ORDER TO MENTAIN THE INSULATING LAYER OF THE ENVELOPE.

THICK GLASS PANELS IN FRONT OF WINDOWS PROVIDE A GREENHOUSE EFFECT THAT LOWER THE THERMAL LOSSES DURING WINTER. DURING SUMMER, WARMER AIR IS CONVECTED VERTICALLY THROUGH THE GAP BETWEEN THE GLASS PANEL AND THE WINDOW GLASS, AVOIDING SUPERHEATING OF THE INDOOR AIR.

ALL CONSOLES ARE INSULATED AT THE SAME LEVEL AS THE EXTERIOR WALLS – 15 CM OF MINERAL ROCKWOOL.

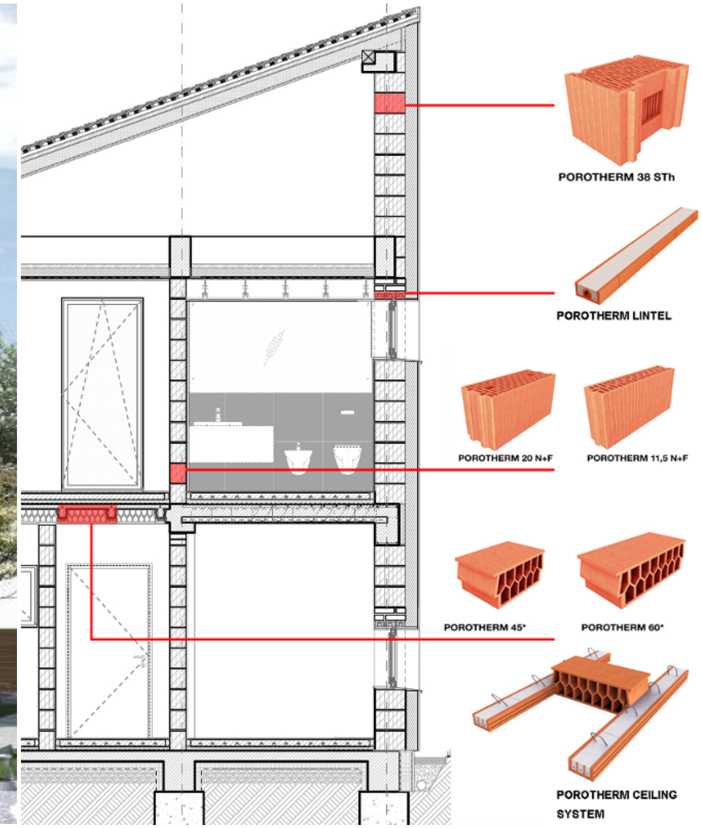
ALL EXTERIOR GROUND TERRACES ARE BUILT ON METAL STRUCTURES, DISCONNETED FROM THE HOUSE GROUND SLAB TO AVOID SIGNIFICANT THERMAL BRIDGES USUALLY ASSOCIATED WITH EXTENDED SLABS TOWARD OUTDOOR.

Construction Optimization – Thermal Bridges

Cradle-to-cradle design principles

TEHNO-MATERIALS

RECYCLED MATERIALS



General External View - South

Clay facing bricks – red colour

Clay tiles – natural red

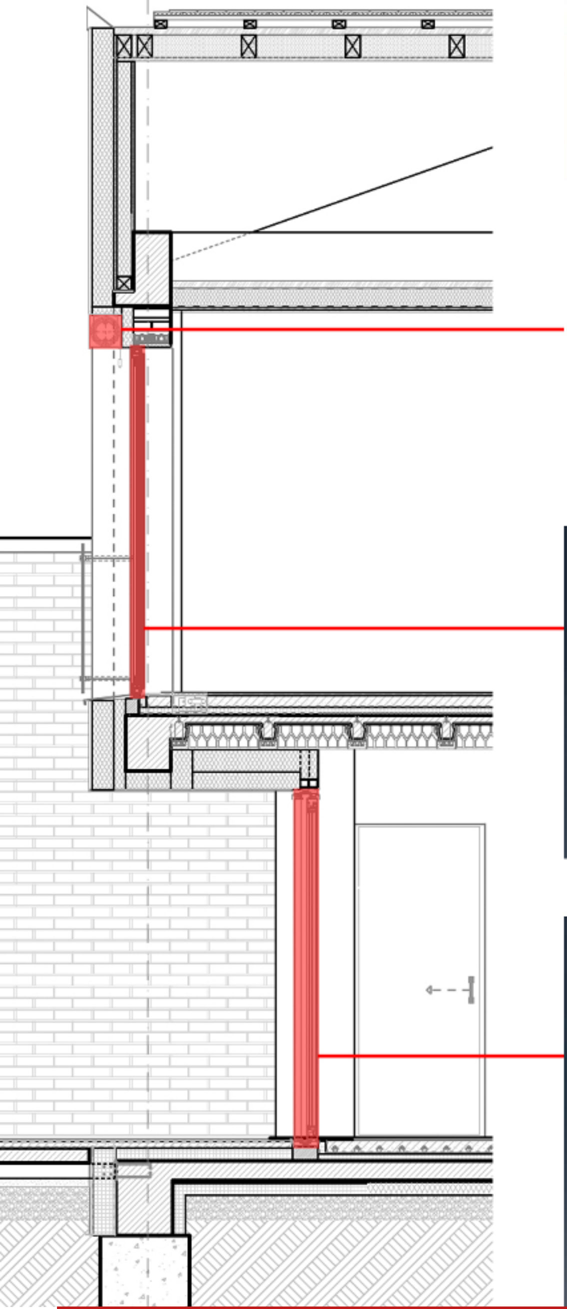
Clay paving tiles

WHITE EXTERIOR PAINT

WHITE ALUMINIUM SILLS

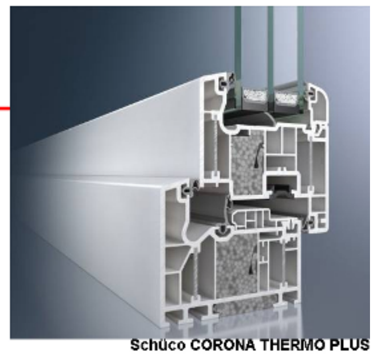
HIDDEN FLASHINGS

View From The Garden



WAREMA SUNSHADING SYSTEM

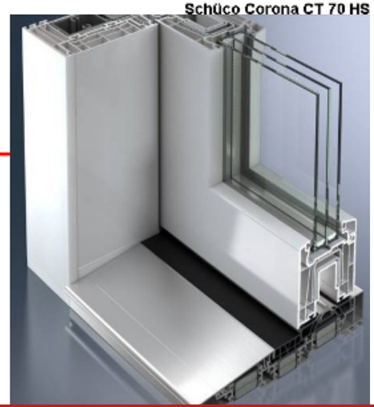
Windows with shading devices
• Without steel windows and foam insulation.
• Profile with 7 rooms with optimized geometry with a depth of 82 mm for best thermal insulation.
• Uf values from 0.76 up to 0.94 W / m² K.
• Large rooms prepared for the introduction of additional insulation.
• triple glazing insulating glass with a thickness up to 52 mm glass package.
• Visible width of 120 mm ensure increased intake of light.



Schüco CORONA THERMO PLUS

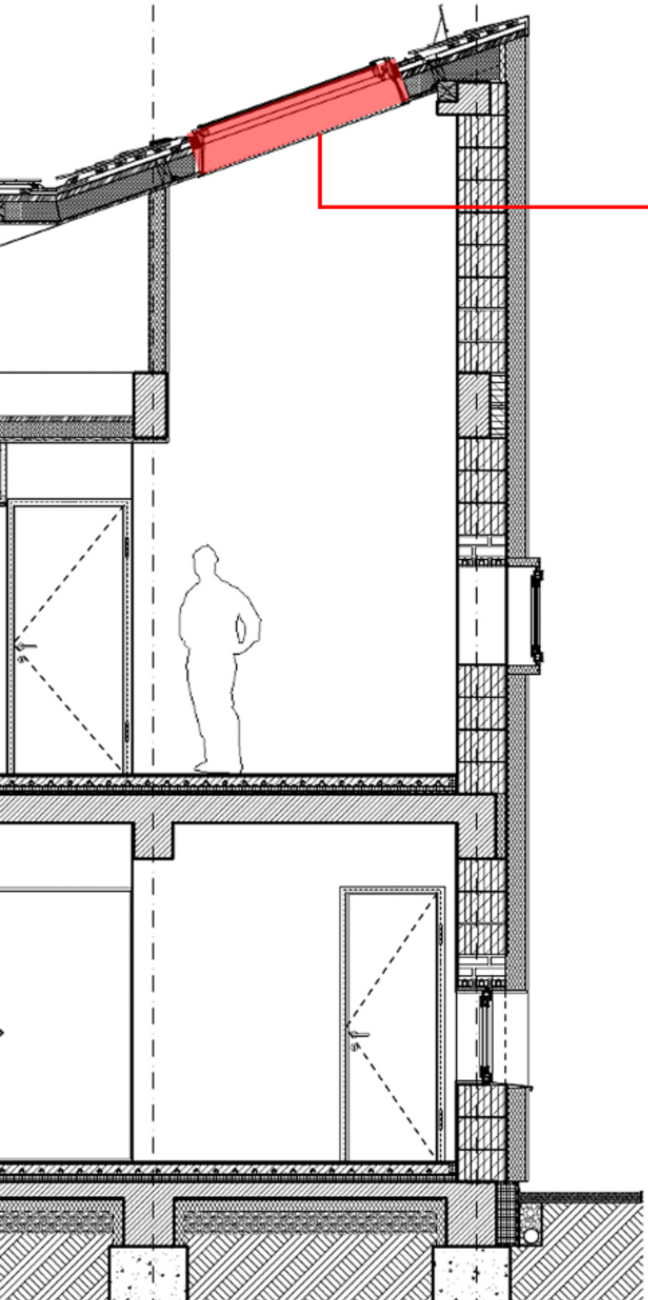
lift-and-slide doors
• Good thermal insulation and sound reduction values. (Uw<=1,4 W/(qmK).
• Air permeability: class 4.
• Resistance to driving rain - class 8A.
• Insulated threshold.

Schüco Corona CT 70 HS



Sunshading System
top-mounted roller shutters for new buildings NA-RO with inspection access outside for masonry or clinker brick facades.
• High-grade, resistant polystyrene with foamed, profiled steel plates for reinforcement.
• The box construction meets the applicable energy saving regulations.

PERFORMANT PVC WINDOWS AND SUNSHADING MOBILE SYSTEMS



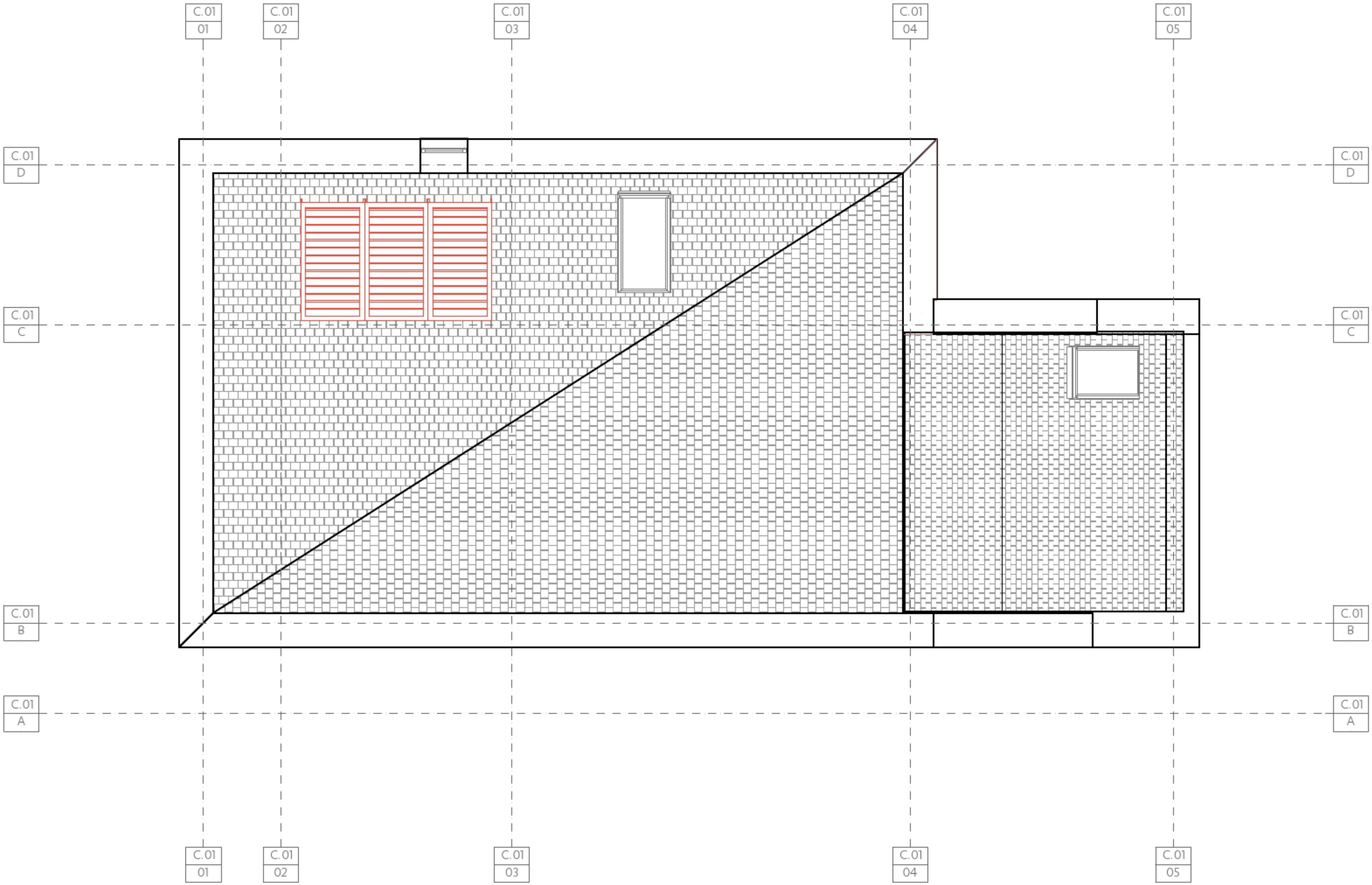
VELUX Window 78 cm x 160cm
Energy efficient 24mm double glazing.
4mm float inner pane with Low-E coating.
4mm toughened outer pane.
Made from pine with triple coat finish.
Easy to use top control bar for opening and even ventilation purposes when the window is closed.

SYSTEM USED - ROOF WINDOWS FOR MAXIMUM NATURAL LIGHT

INTERIOR FINISHING – NATURAL MATERIALS

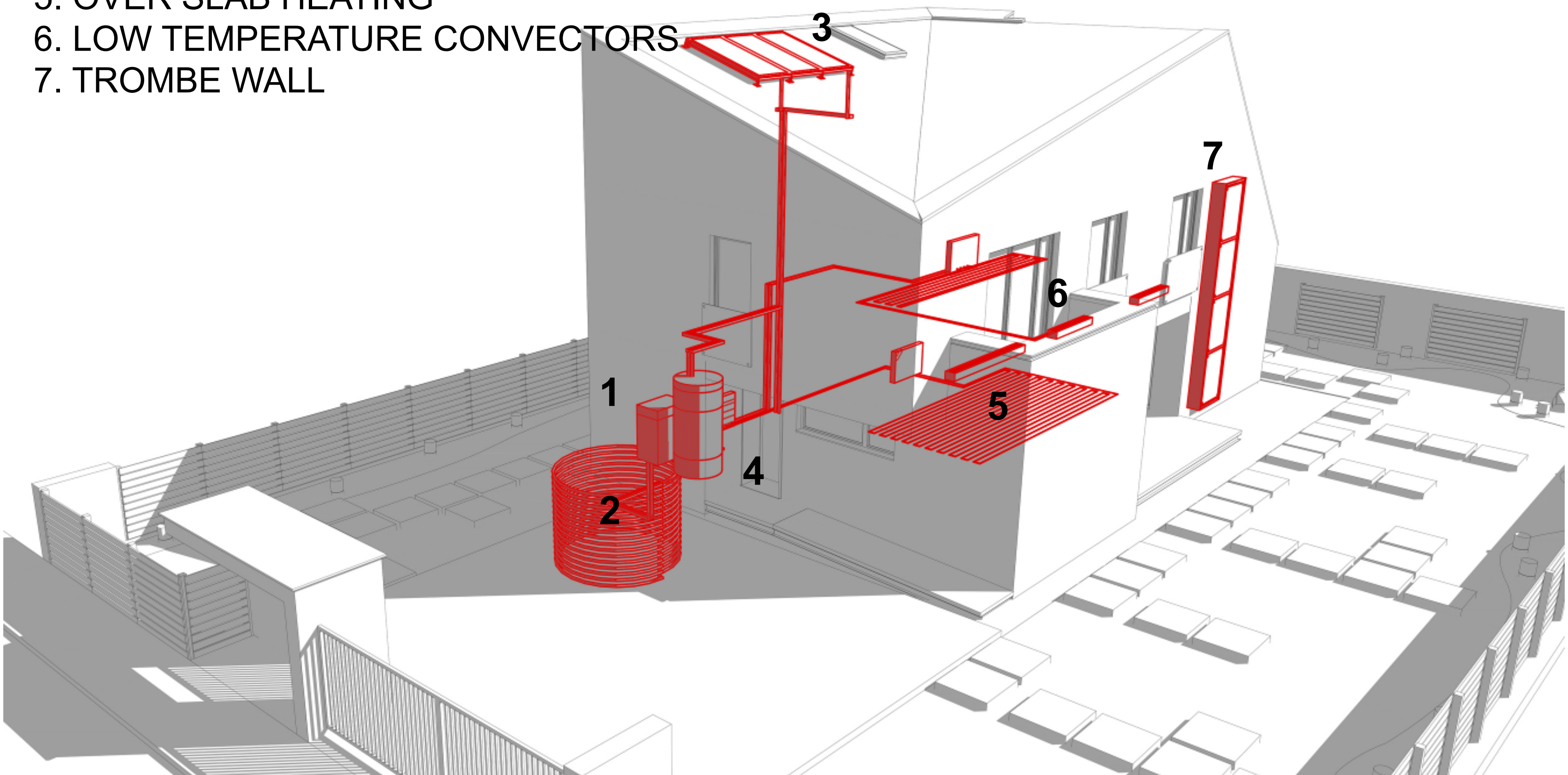
Energy efficiency active strategies

- 3 Solar Collectors for DHW and heating connected to a heat storage tank of 1000 l
- In addition there is room for positioning up to 10 PV panels (optional)



Roof

1. EARTH TO WATER REVERSIBLE HEAT PUMP
2. UNDERGROUND TUBES
3. SOLAR COLLECTORS
4. HOT/WARM WATER DOUBLE STORAGE TO PROVIDE HEAT FOR BOTH DHW AND HEATING PIPING.
5. OVER SLAB HEATING
6. LOW TEMPERATURE CONVECTORS
7. TROMBE WALL



EXTERNAL VIEW FROM ABOVE – HEATING SYSTEM

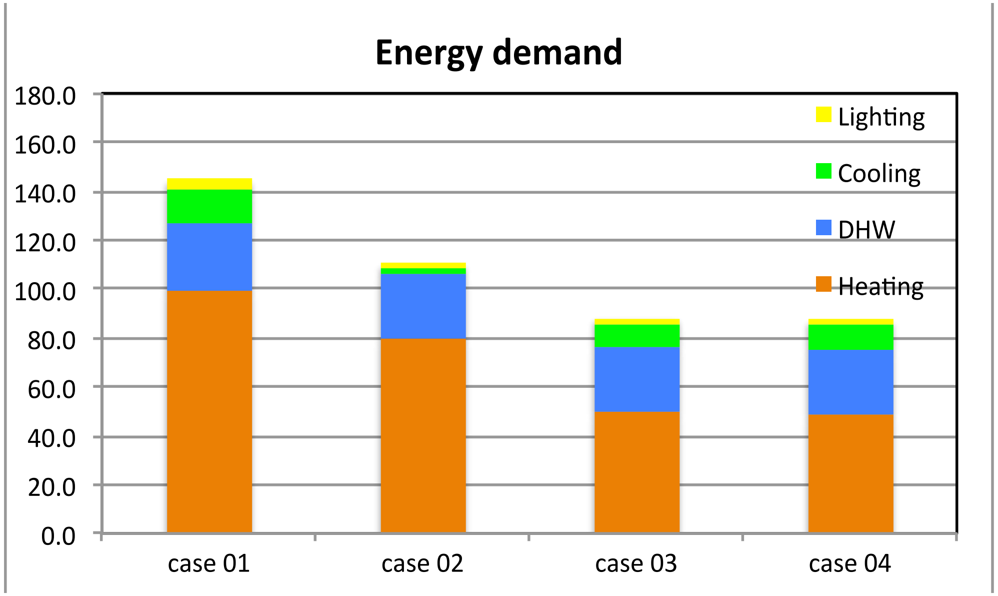
Case studies

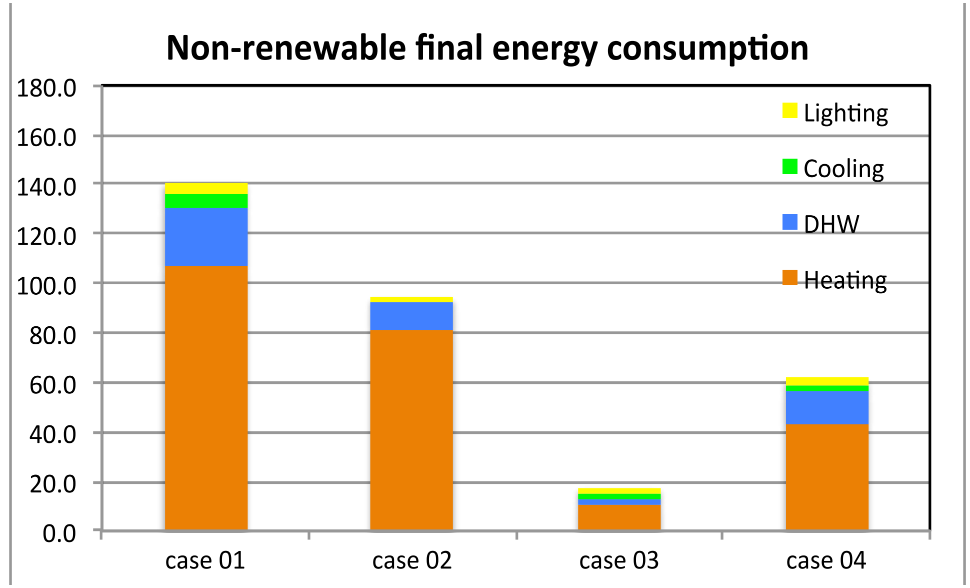
Study Case 01: Standard new house (baseline) – at current national standards, no renewable energy sources. It uses a gas boiler for heating and DHW and a commercial split system for cooling.

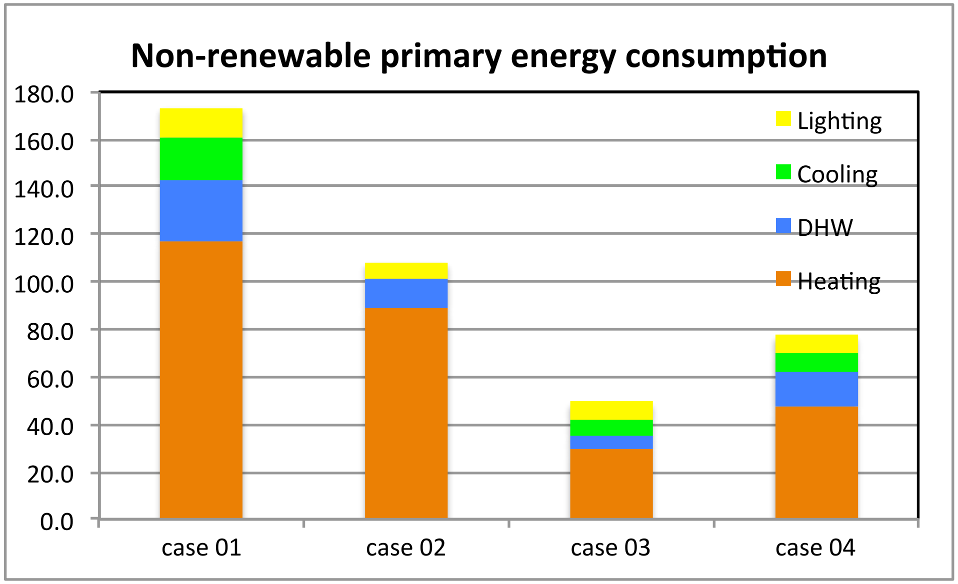
Study Case 02: E4 standard - masonry 38 cm + 10 cm EPS, ground slab insulated with 5 cm XPS, consoles with 10 cm EPS, roof with 15 cm mineral wool, 15 cm XPS for terrace, PVC windows with double glazing, solar panels for partial DHW, Trombe wall, biomass central heating and natural cooling by night ventilation.

Study Case 03: E4 premium with heat-pump – masonry 38 cm + 14 cm mineral wool, ground slab insulated with 10 cm XPS, consoles with 15 cm mineral wool, roof with 20 cm cellulose and adaptive humidity membranes, 20 cm XPS for terrace, PVC windows with triple glazing, solar panels for partial DHW, Trombe wall, and geothermal heat pump for heating and cooling.

Study Case 04: E4 premium with boiler on biomass – masonry 38 cm + 14 cm mineral wool, ground slab insulated with 10 cm XPS, consoles with 15 cm mineral wool, roof with 20 cm cellulose and adaptive humidity membranes, 25 cm XPS for terrace, PVC windows with triple glazing, solar panels for partial DHW and heating, electric split for cooling and boiler on pellets.



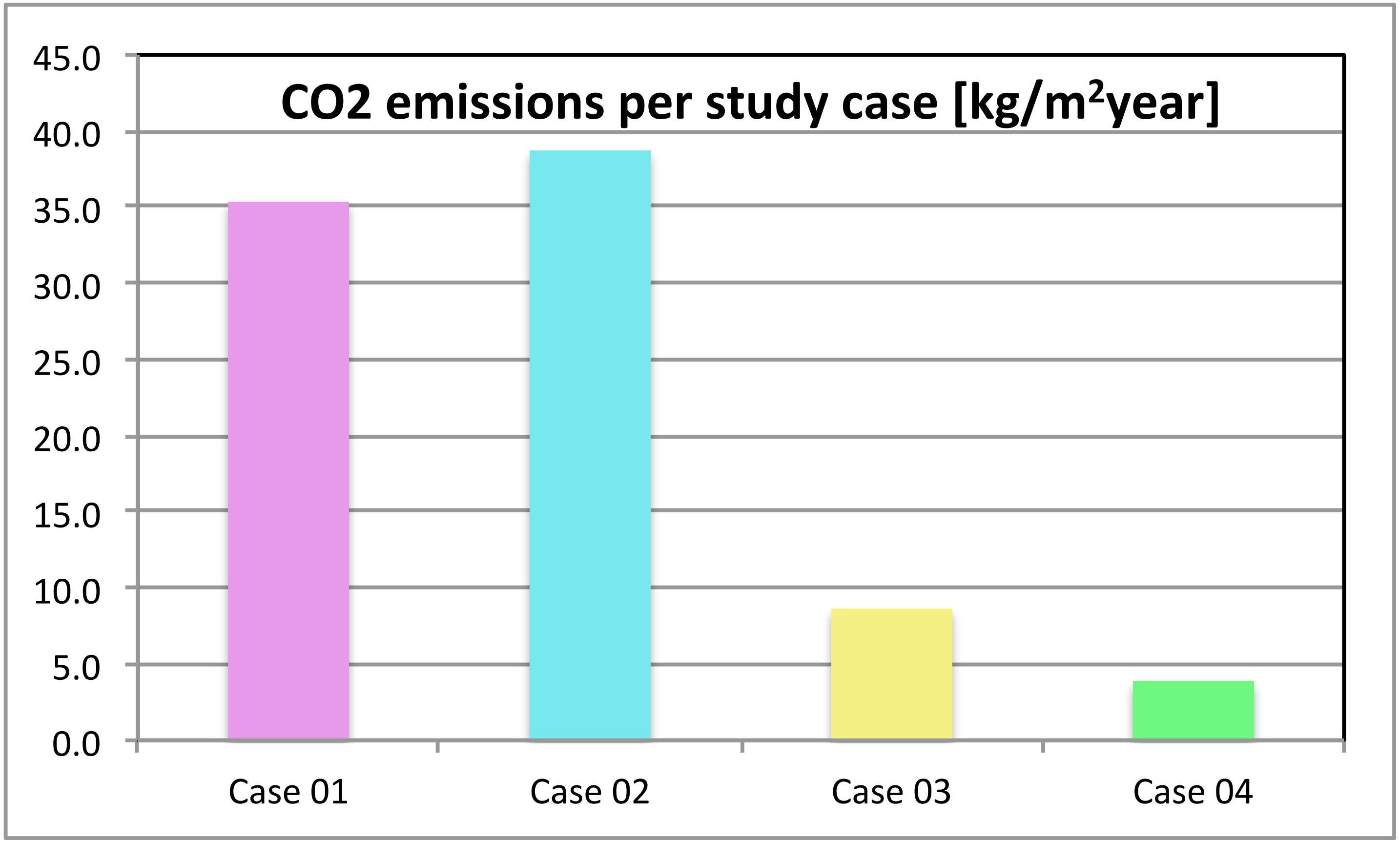




Final to primary conversion factors:
1.1 for heat
2.8 for electricity

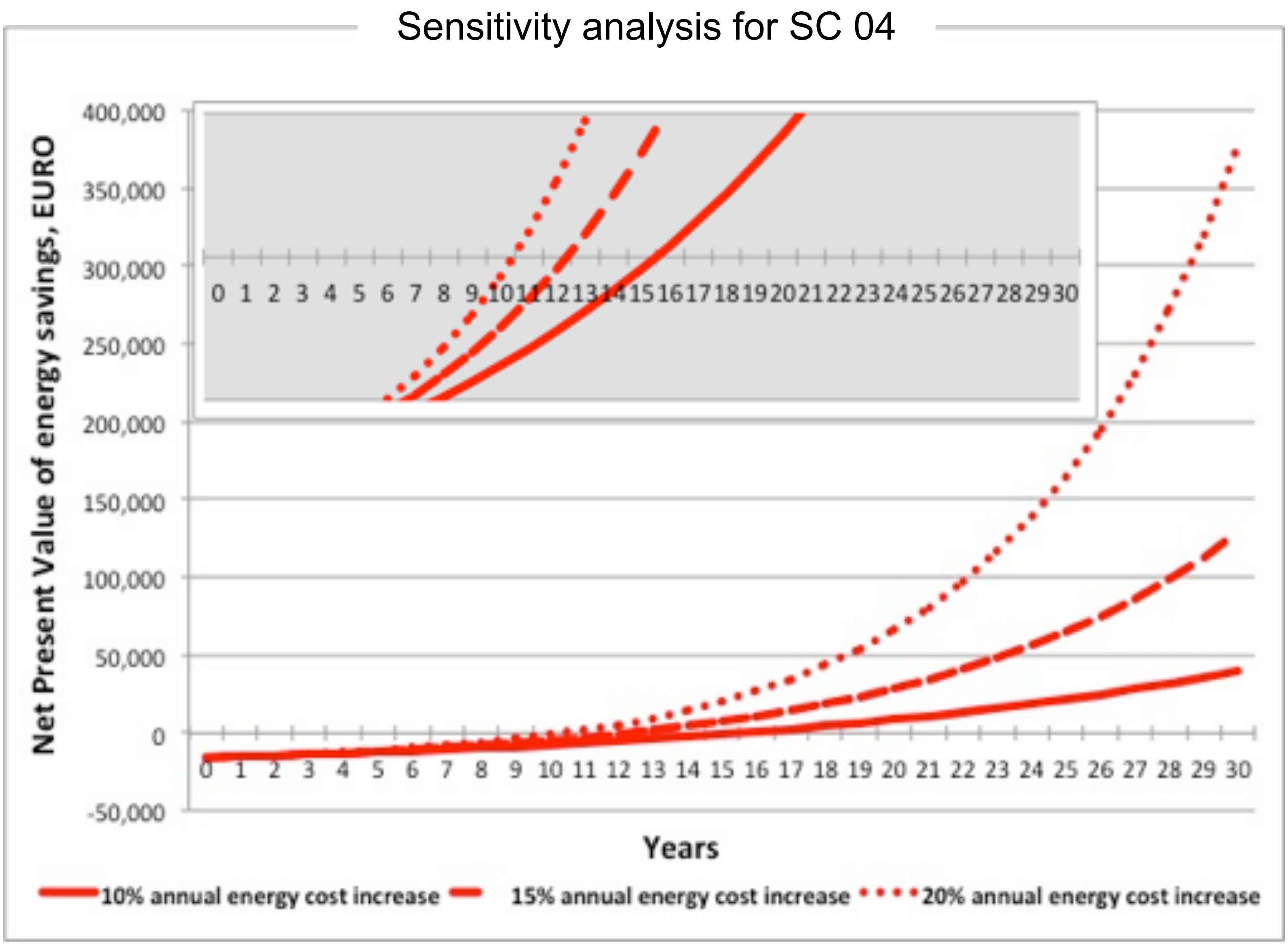
Energy demand to primary energy

GHG Emission calculations



Environmental performance

Study case	Case 01	Case 02	Case 03	Case 04
Payback times	**0 (reference)**	**14.1**	**17.9**	**12.8**



Return of investment schedule

Conclusion

- ✓ From the primary energy consumption alone, the case based on heat pump (case 03) seems the most efficient.
- ✓ However, when the overall economical efficiency and environmental effects are considered, the house based on biomass and solar energy (case 04) is the most attractive.
- ✓ As usually, the decision belongs also to the person paying for the house and/or living in it, as personal income plays as always a major role. It remains the role of the designer to educate the beneficiary, no matter who is, about the advantages in medium and long terms of having a NZEB type of house.
- ✓ This E4 house will be built in 2014. The plan is to ensure a good execution work and then monitor the house behaviour in association with users awareness on how to use it. Special attention will be awarded to the Trombe wall performance and its contribution to the overall indoor comfort for both summer and winter times. Costs with energy and overall happiness of users are to be proven as well.
- ✓ **The NZEB will be more and more affordable/attractive, as energy price increases (strategy & policy) and technology prices decreases (knowledge spread & competitiveness).**