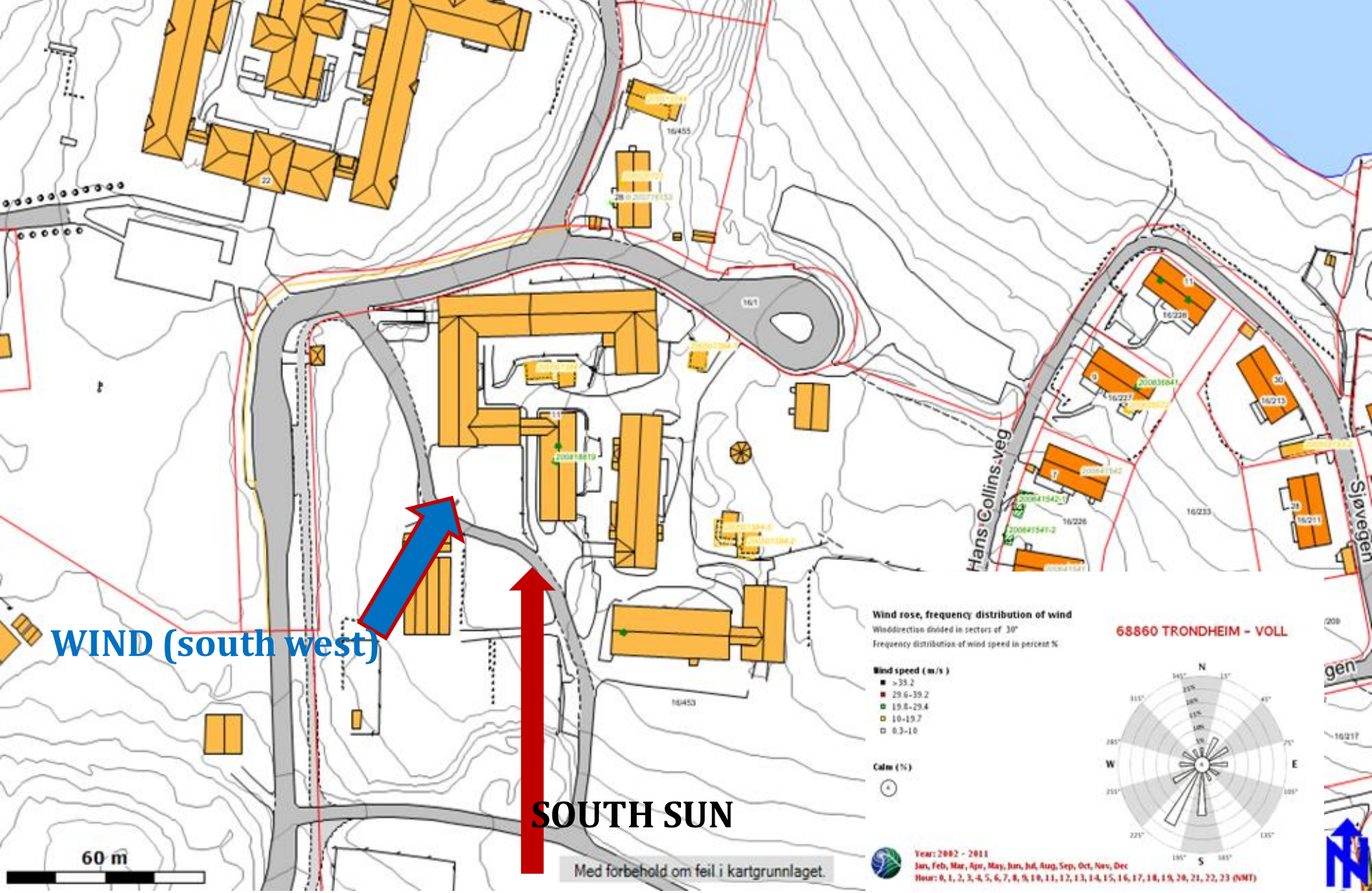
GROUP 05

PROJECT STATEMENT:
CAMPHILL Rotvoll is an interdisciplinary effort to raise awareness and competency regarding sustainable architecture in the building sector. The project aims to complete Scandinavia`s first retrofit of a single unit building to zero-energy standards.

THE AIM:
To develop a house for students with special needs to live, to learn, to work and to communicate with the society.

By
Javad Darvishi
Syed Hasnain Abbas Shah
Safura Abdiha

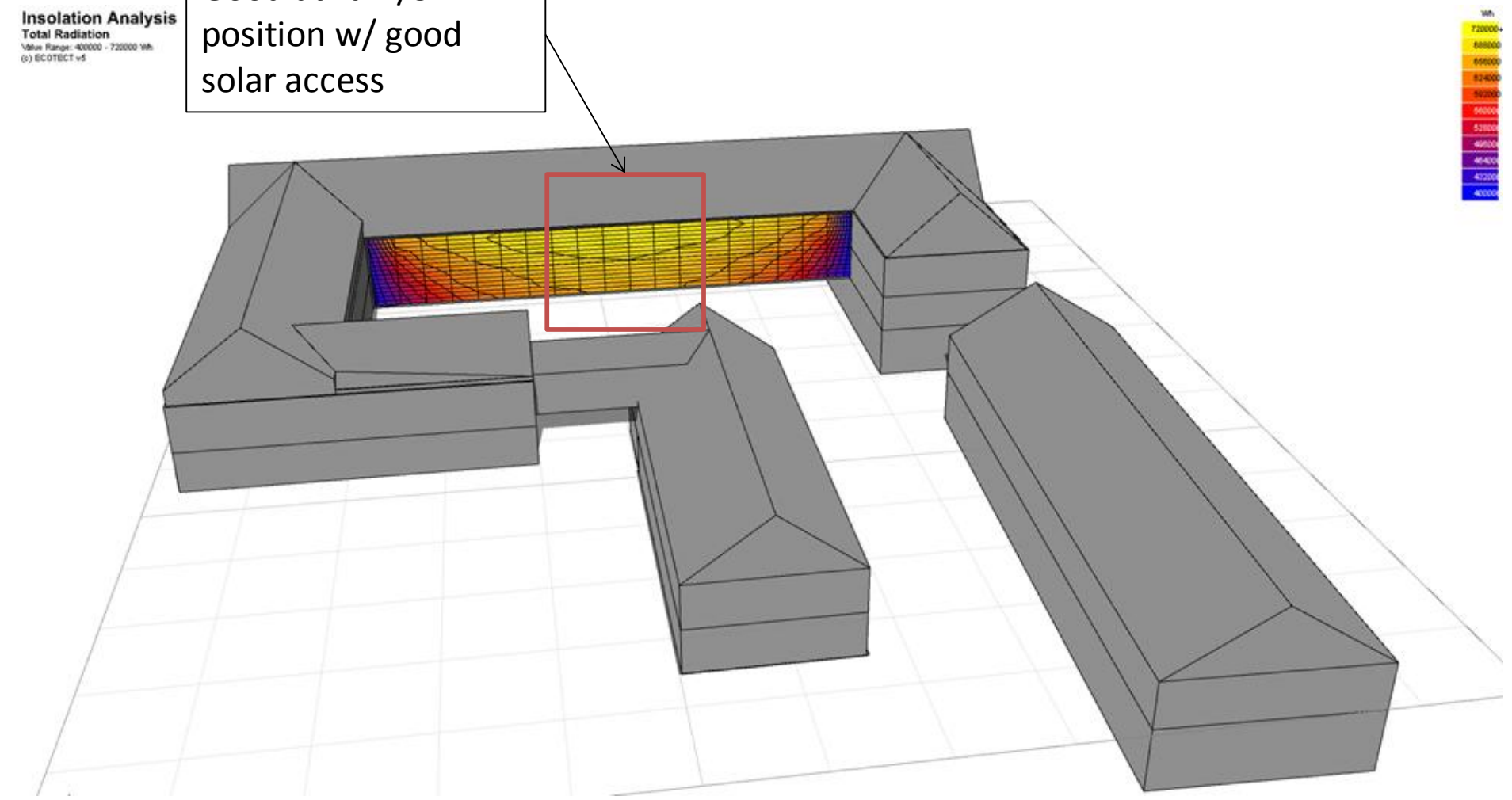
THE REFURBISHMENT OF ROTVOLL BARN



SITE LOCATION & ENVIRONMENTAL FEATURES

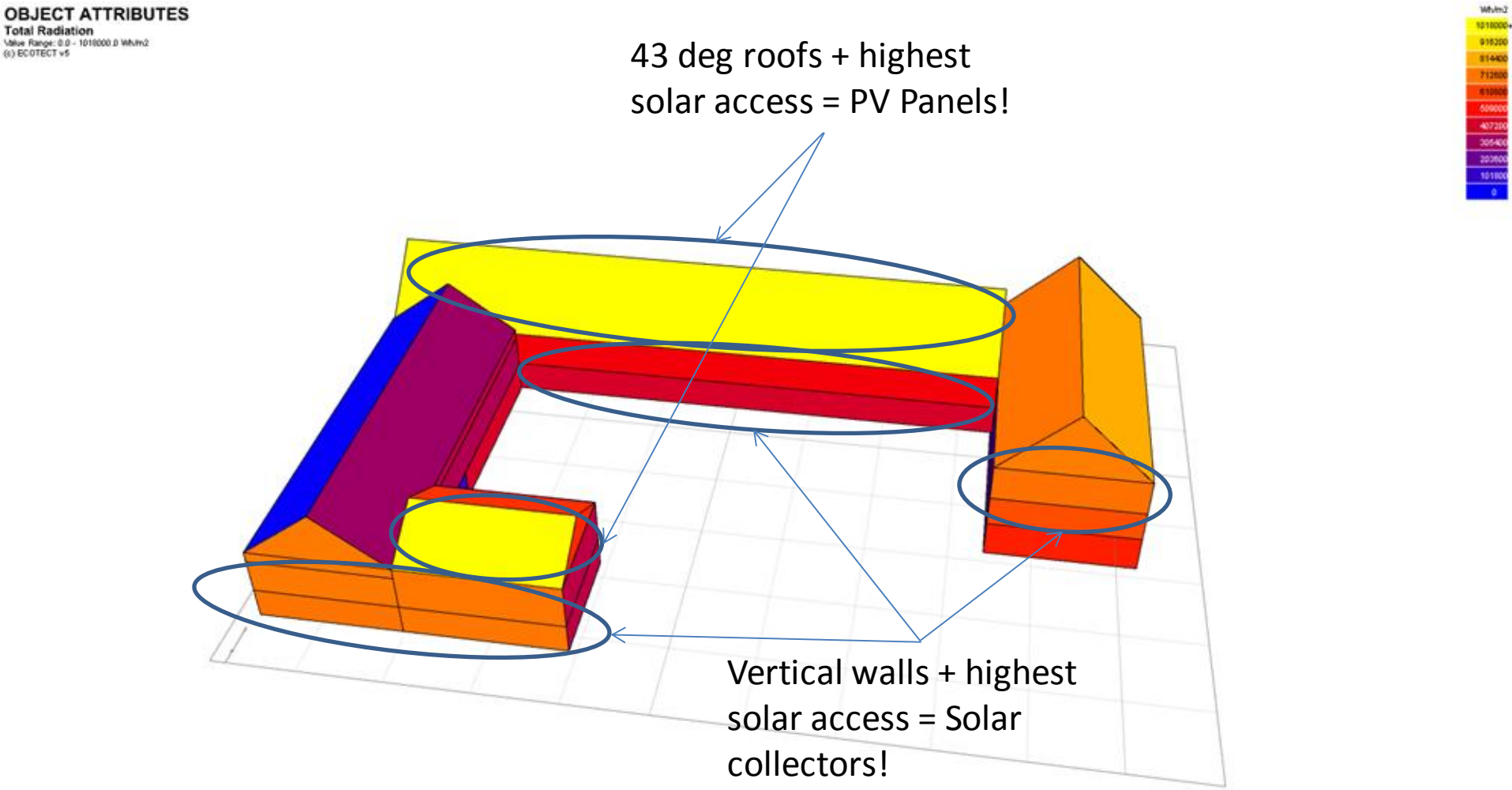
SITE CONDITIONS AND FEATURES

ATRIUM & DOUBLE SKIN FAÇADE

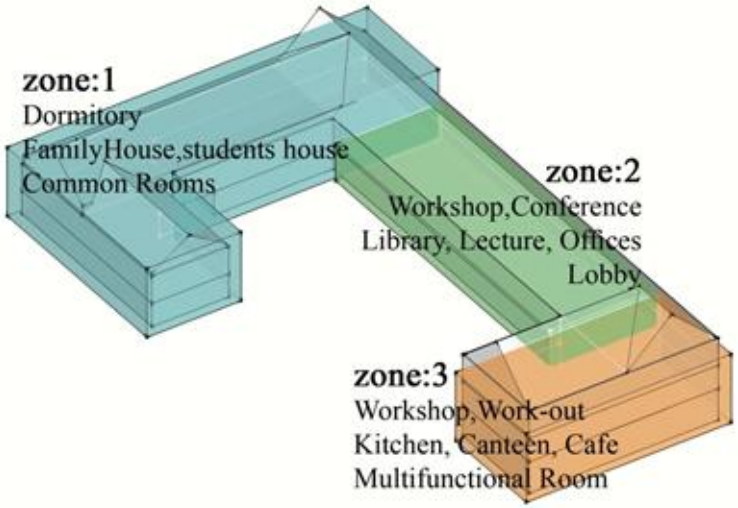


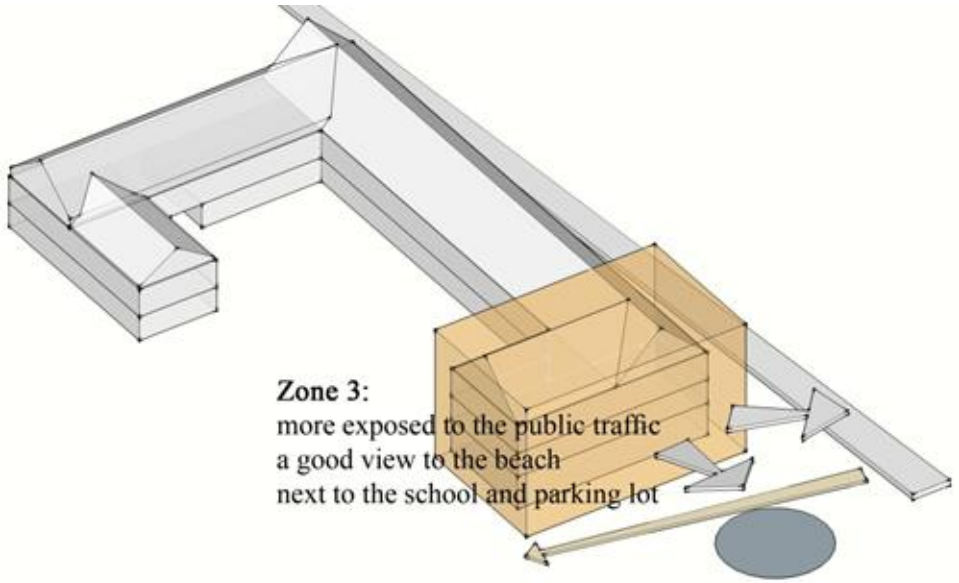
ECOTECT SOLAR ACCESS ANALYSIS

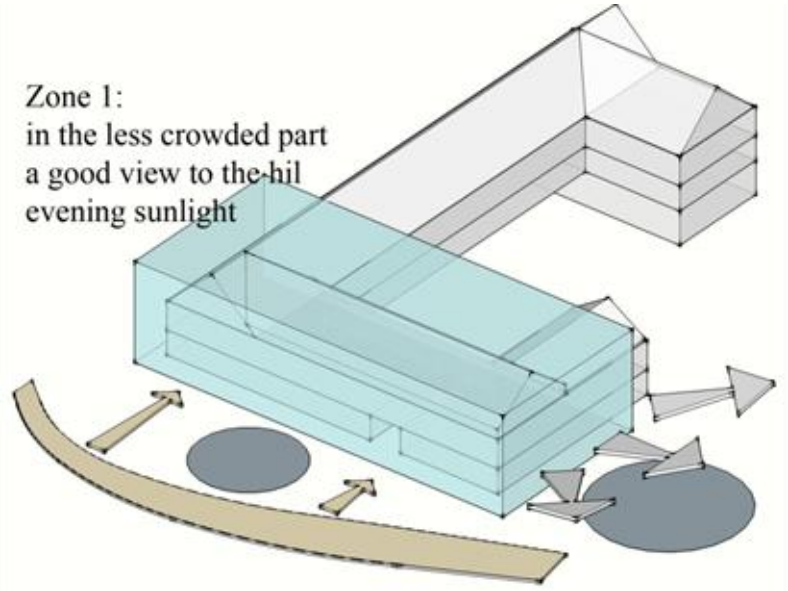
Solar collector and PV positions

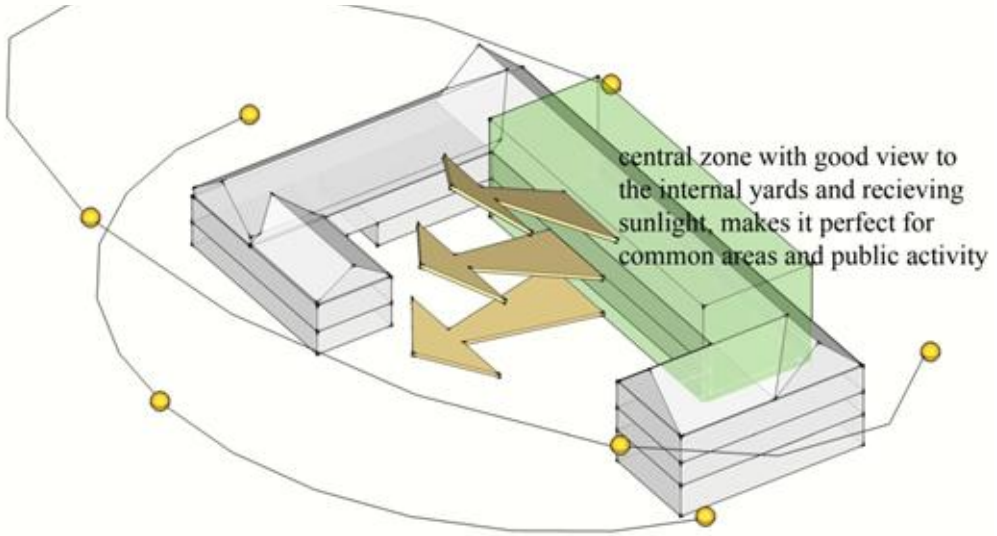


ECOTECT SOLAR ACCESS ANALYSIS



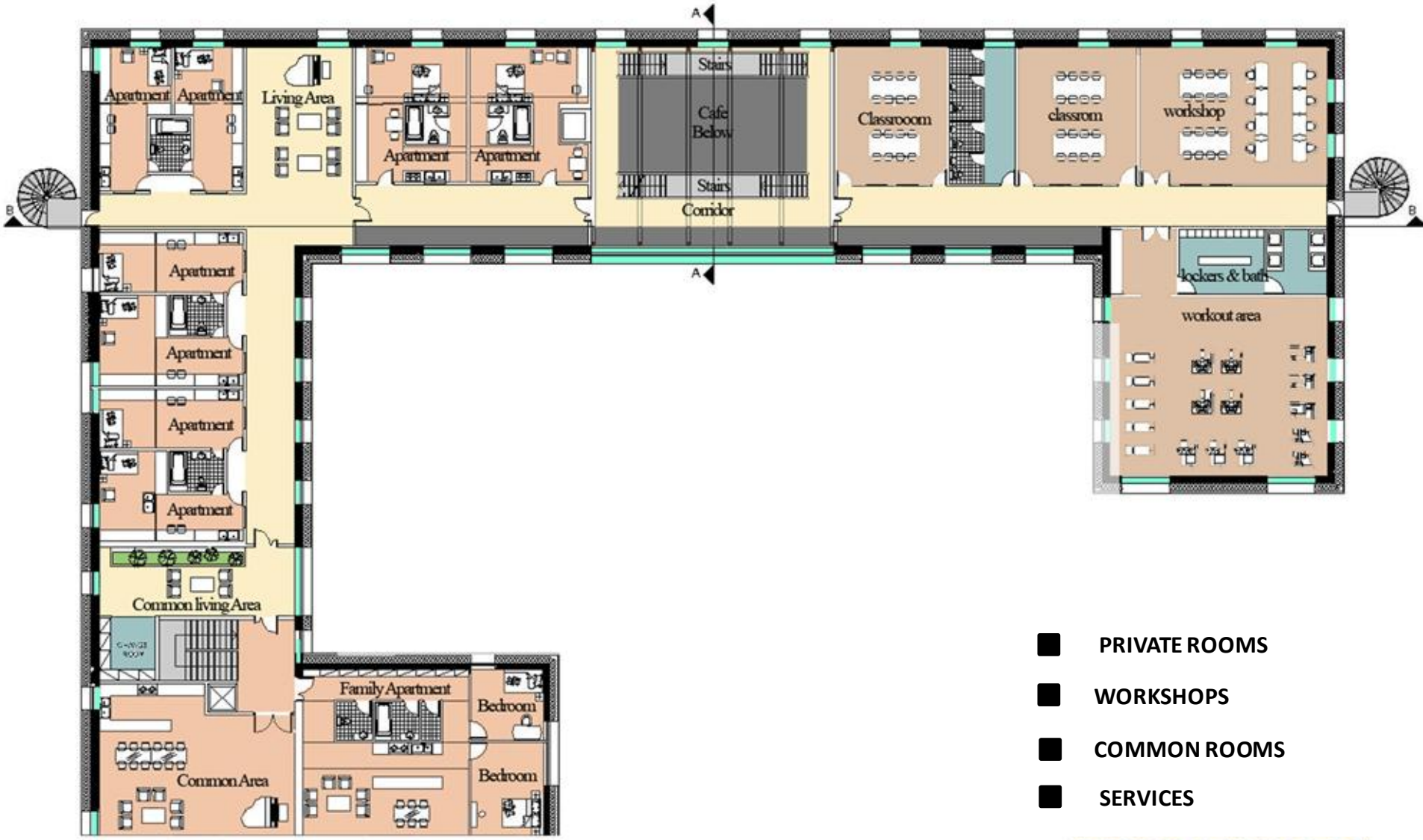




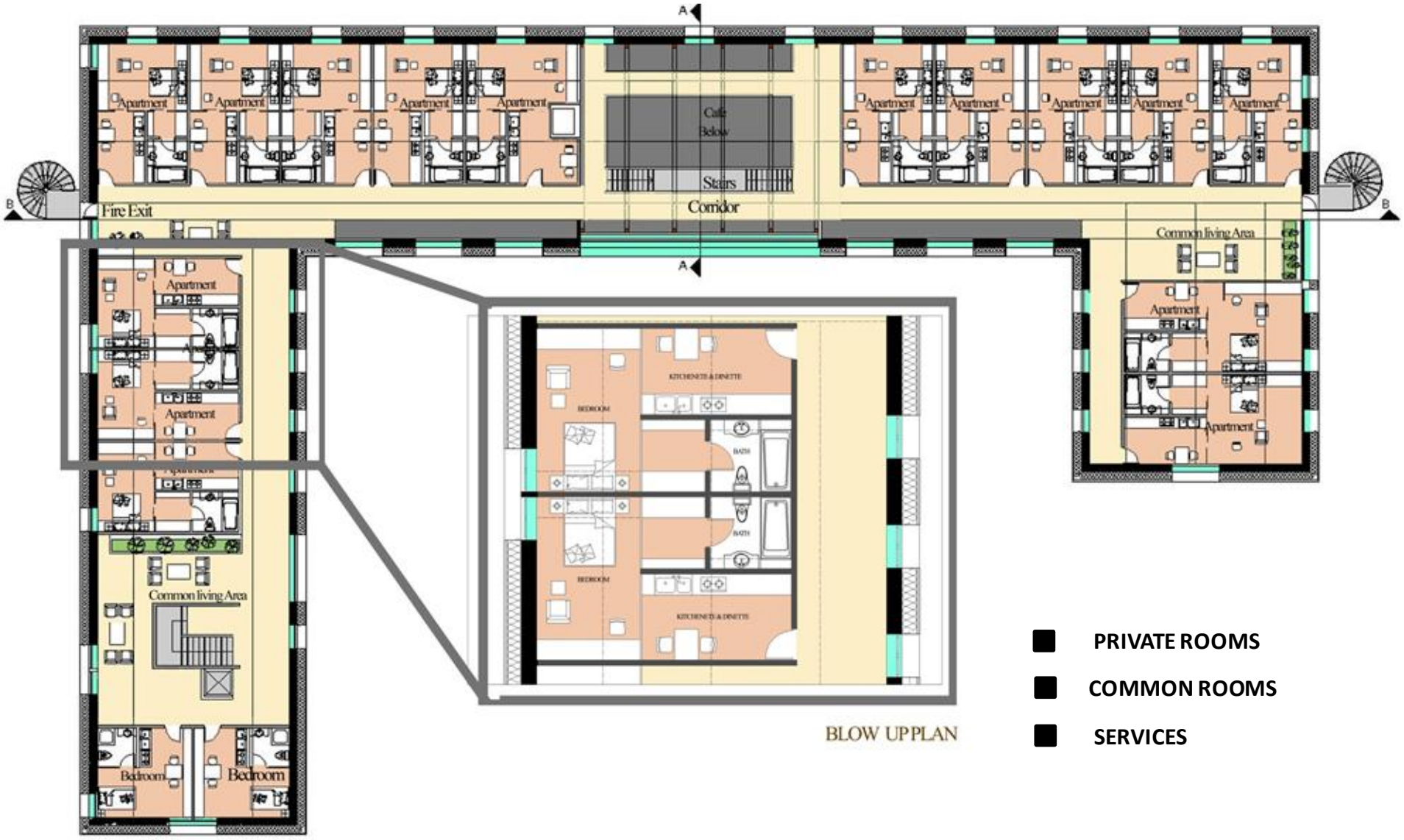


DESIGN CONCEPT

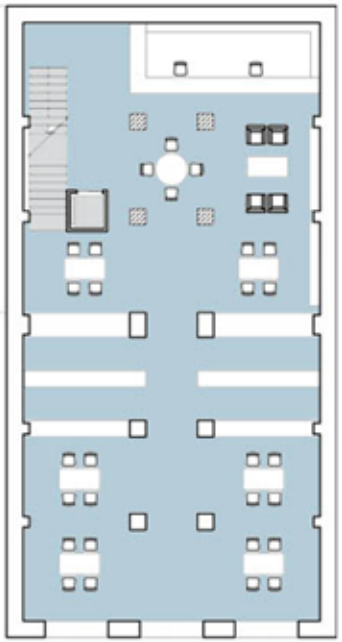
FIRST FLOOR PLAN



SECOND FLOOR PLAN

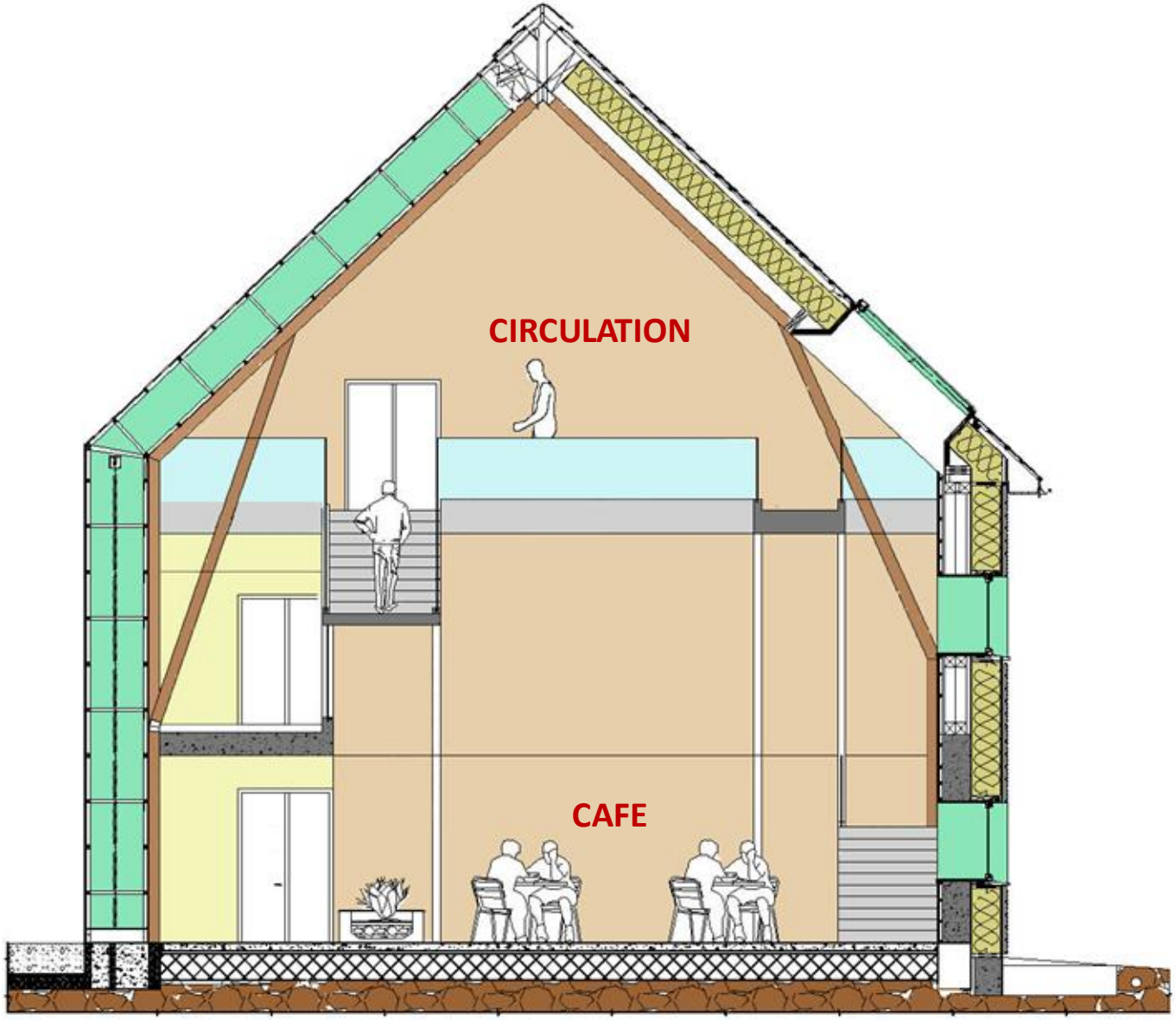


TOP FLOOR PLAN

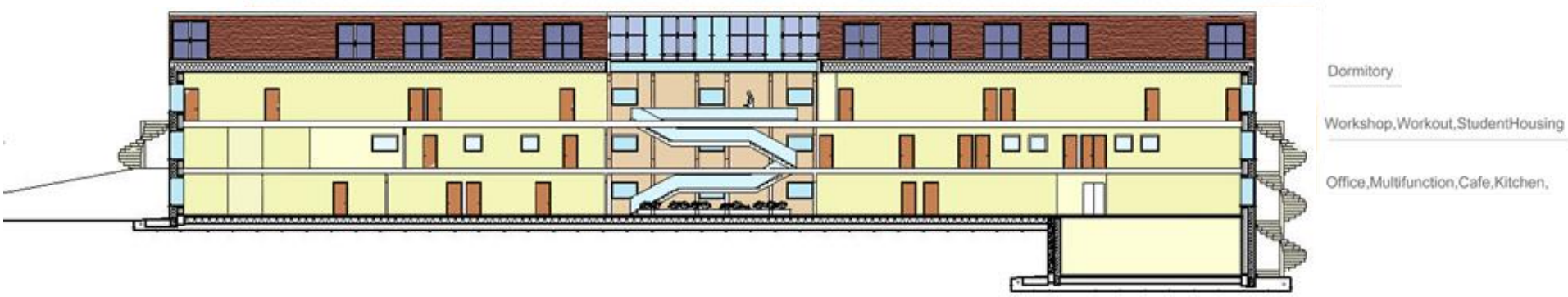


WORKSHOPS

BASEMENT FLOOR PLAN



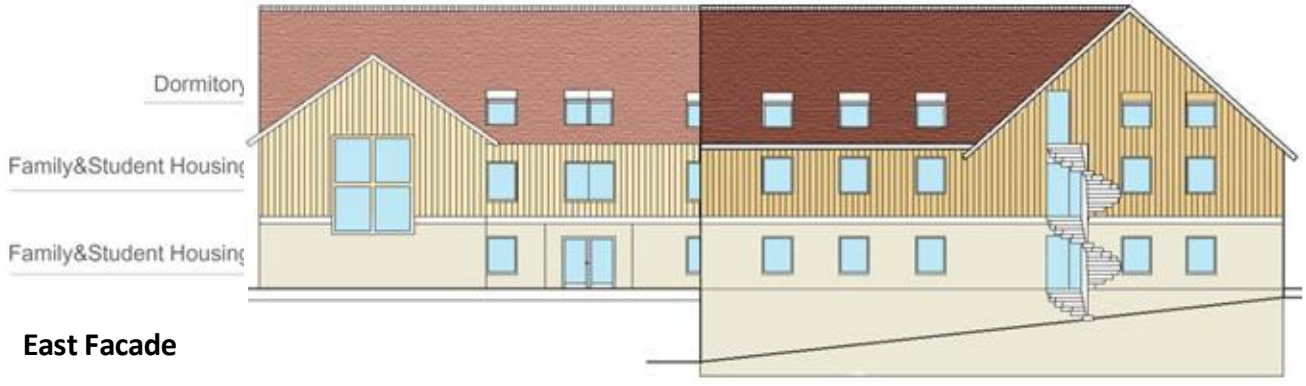
SECTION AA



Section BB

South Facade

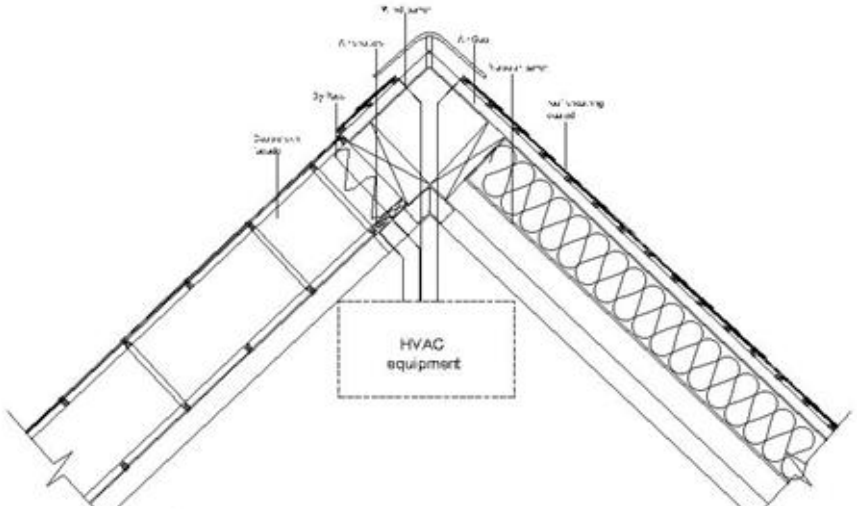
FAÇADE

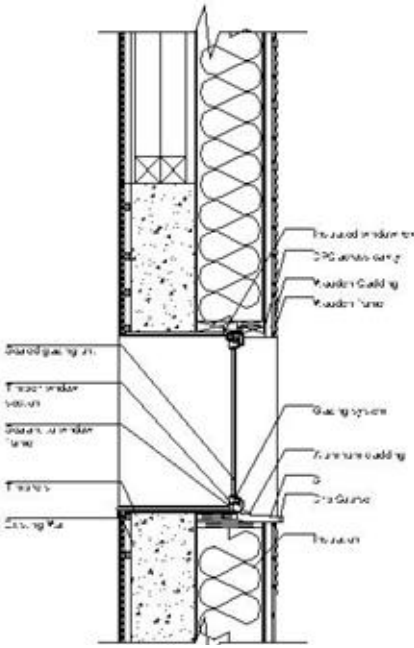


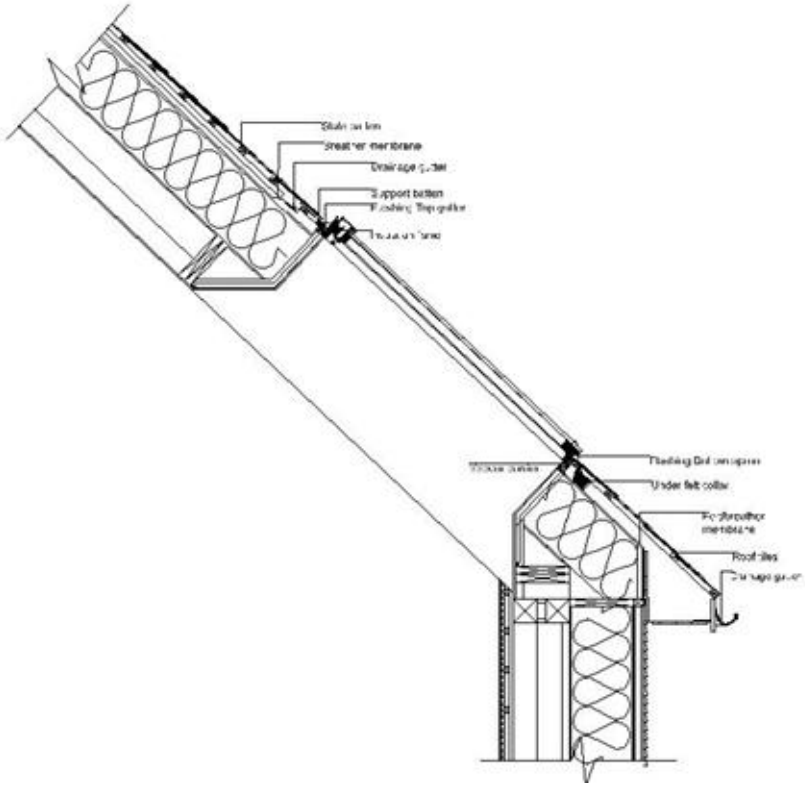
East Facade

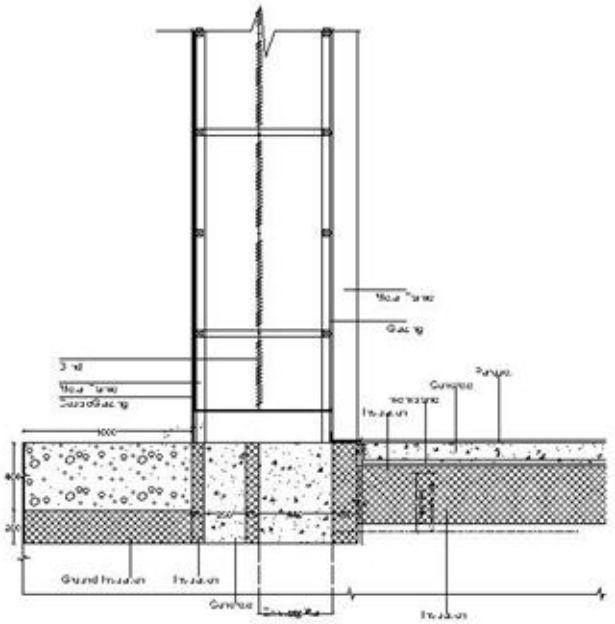
West Facade

FAÇADE

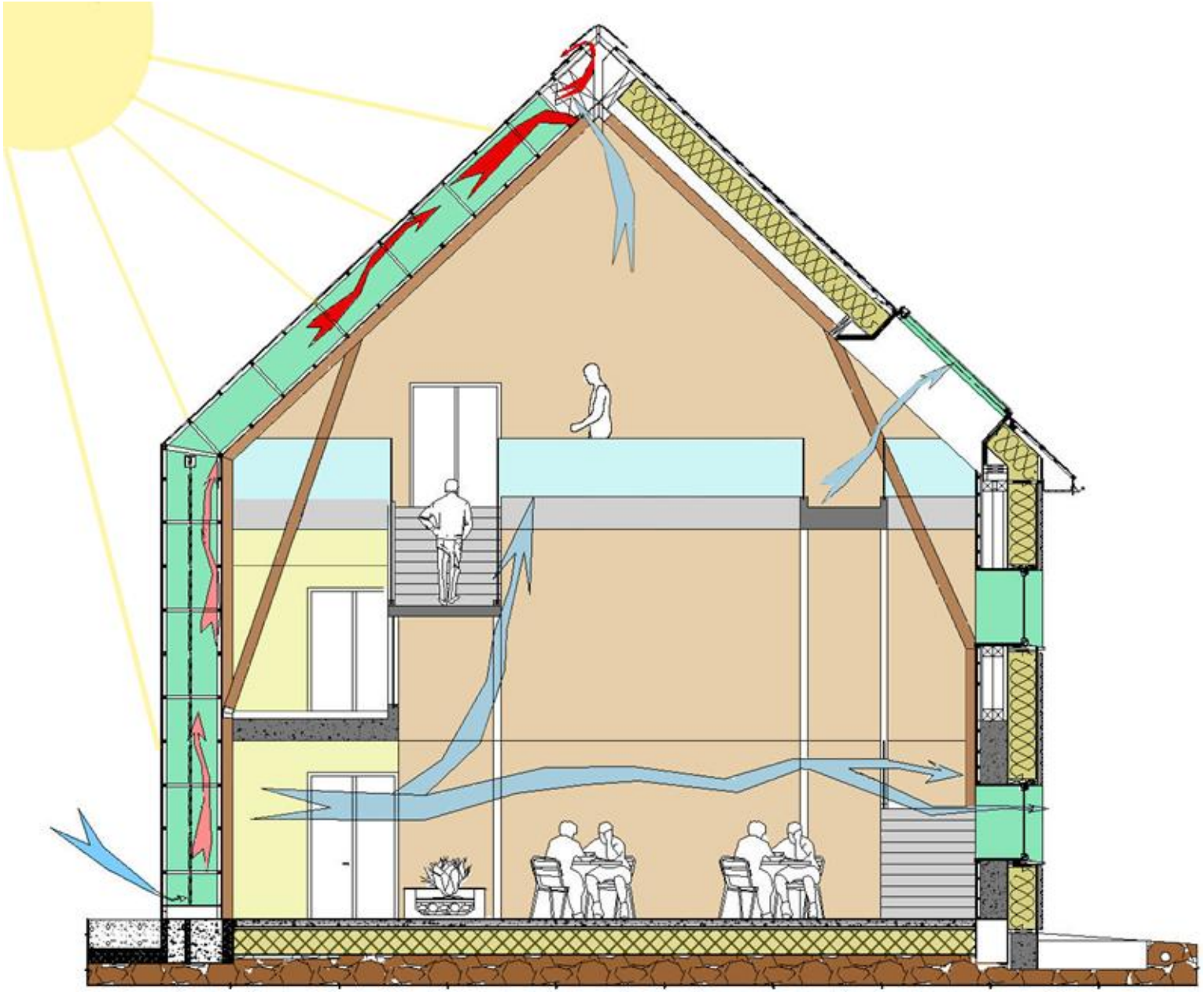




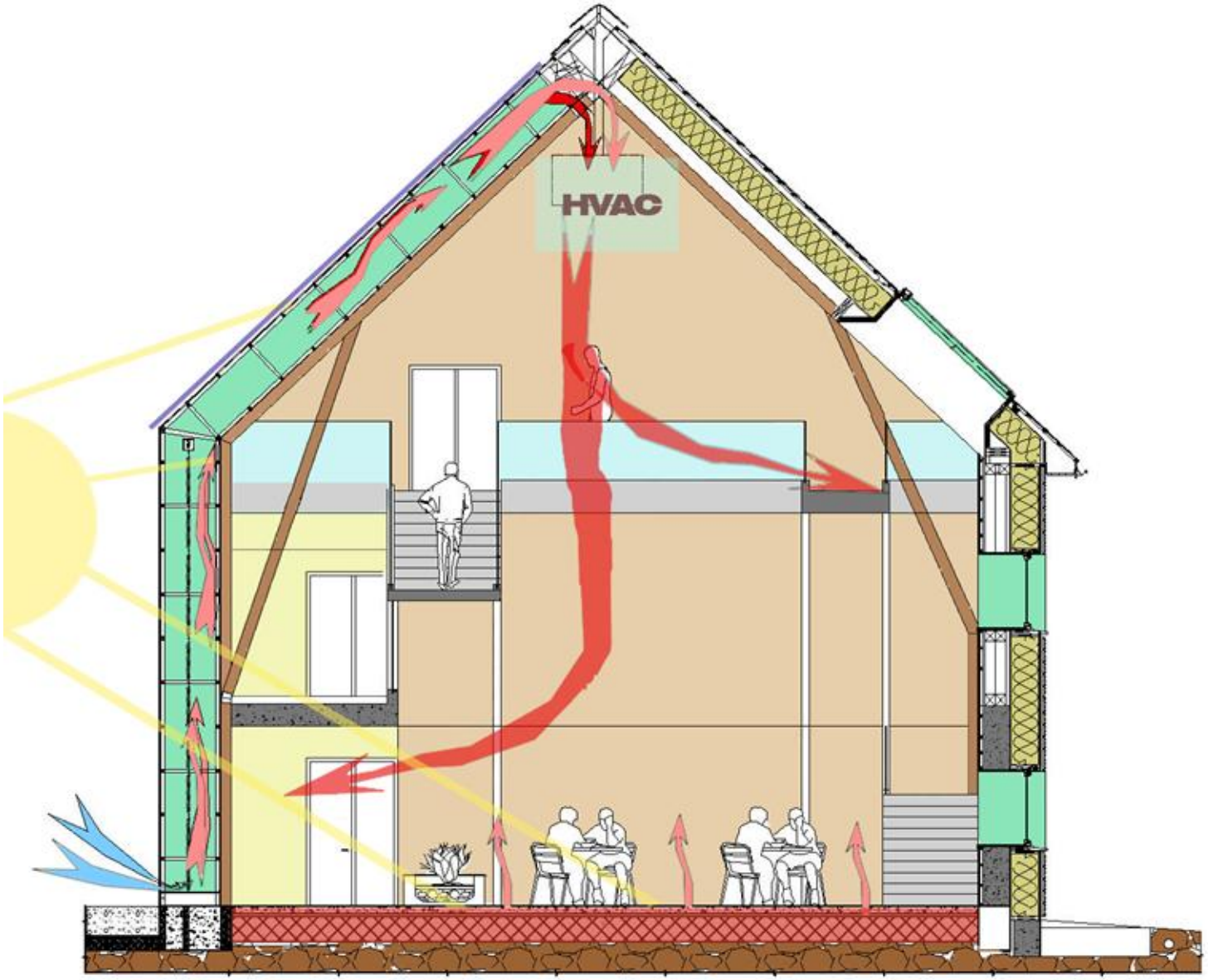




STRUCTURAL DETAILS

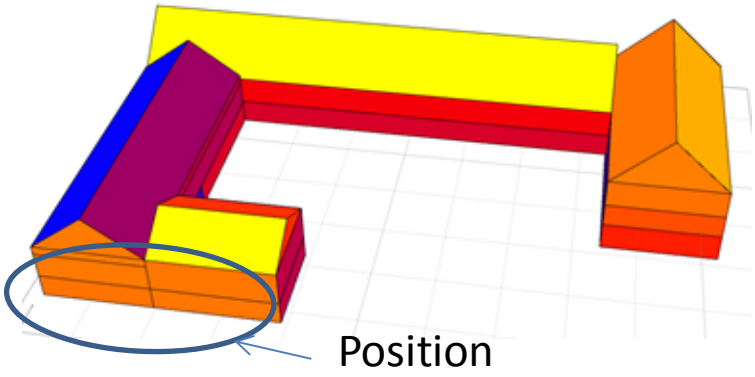


SUMMER ENERGY STRATEGY



WINTER ENERGY STRATEGY

- 1 family = 3 persons ; “2 bed house” ; (1xU12)
- 6 students ; “5 bed House” ; (4xS08)
- We have 2 families and 12 students
  - 2 of U12 + 2 of 4xS08 ; 2x2.5m2 + 8x6.4m2 > **<u>17.8 m2</u>**



VELUX solar collectors can also be installed side by side with VELUX roof windows.

This table provides an example of the sizes of collector available and how many collectors per person in each household are required.

Typical solar hot water system	2 bed house 2/3 person 180 litre tank	3 bed house 3/4 person 280 litre tank	4 bed house 4/5 person 280 litre tank	5 bed house 5/6 person 375 litre tank
U12 option 2.50m² per collector	1 x U12 (2.50m²)	2 x U12 (5.00m²)	2 x U12 (5.00m²)	3 x U12 (7.50m²)
S06 option 1.35m² per collector	2 x S06 (2.70m²)	3 x S06 (4.05m²)	4 x S06 (5.40m²)	5 x S06 (6.75m²)
S08 option 1.60m² per collector	2 x S08 (3.20m²)	3 x S08 (4.80m²)	4 x S08 (6.40m²)	4 x S08 (6.40m²)
M08 option 1.09m² per collector	3 x M08 (3.27m²)	4 x M08 (4.36m²)	5 x M08 (5.45m²)	6 x M08 (6.54m²)

The range of VELUX collectors allow you to choose a solution that suits your requirements giving you flexibility in choice.

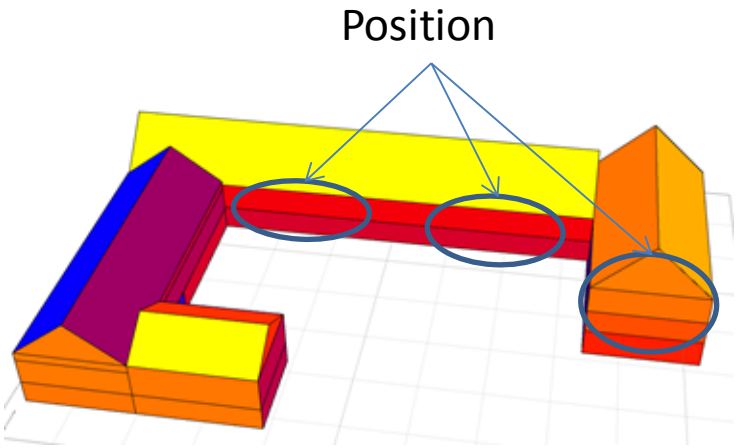
Available in four different sizes and using standard VELUX flashings, it can even be combined with new or existing VELUX roof windows to ensure a visually attractive roof design.

For information on which option is the correct one for you, please contact a specialist installer who will be able to give you a customised quote. For more information on where to find an accredited solar installer please visit www.carbon-neutralhome.co.uk or www.carbon-neutralhome.ie

SOLAR COLLECTOR PLACEMENT 01

- 16-20 students ; 4 of “5 bed House”; 4 of (4xS08)
  - 4x(4xS08) ; 4x6.4m2 > **<u>25.6 m2</u>**

<u>Total we need 25.6+17.8 > 43.4 m2</u>



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S08 option 1.60m² per collector	2 x S08 (3.20m²)	3 x S08 (4.80m²)	4 x S08 (6.40m²)	4 x S08 (6.40m²)
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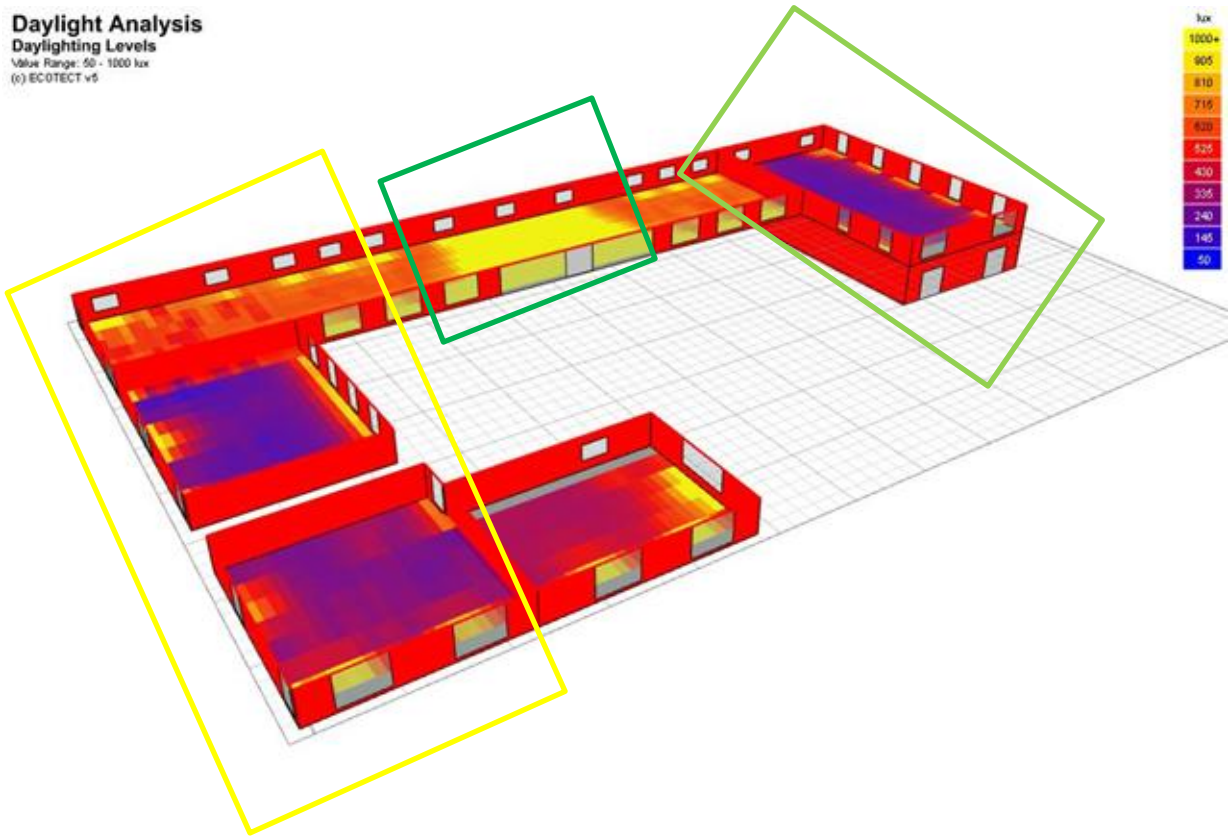
SOLAR COLLECTOR PLACEMENT 02

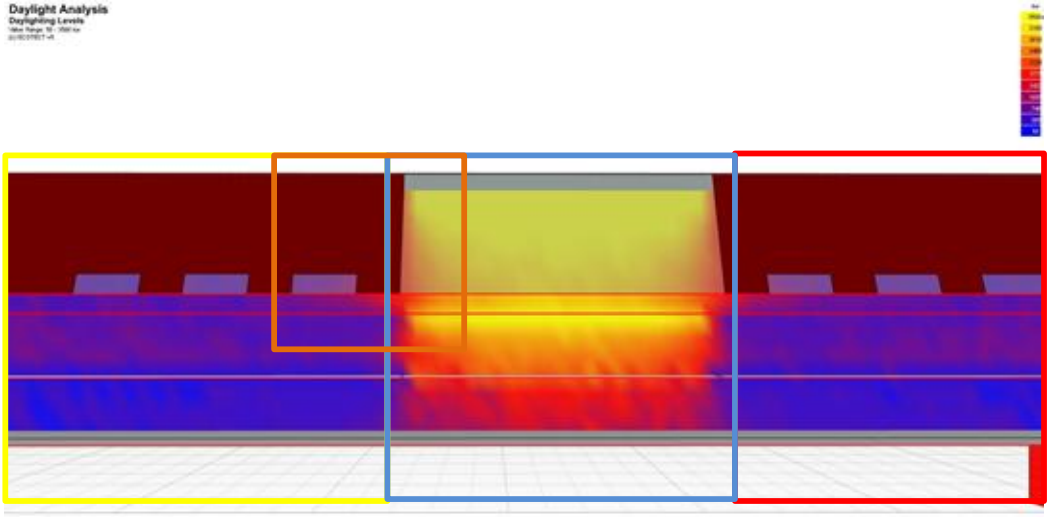


Casual assembly work	200
Rough/heavy work	300
Medium assembly work	500

Dwellings	
Living / reading / study	50 / 150 / 300
Kitchen / bedroom / hall	300 / 50 / 150

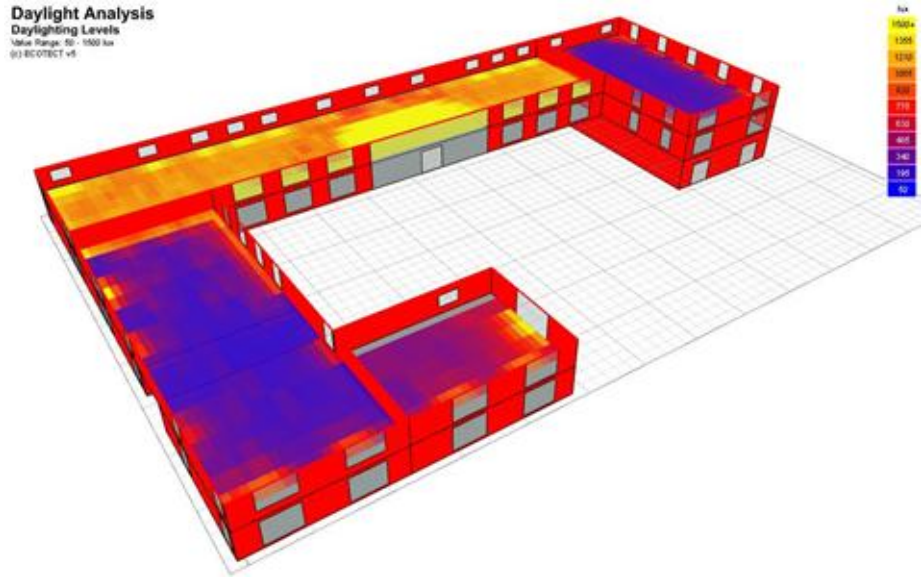
Location	Illuminance (lux or lm/m2)	Limiting glare index
Entrance hall	150	22
Stairs	150	22
Corridor	100	22
Outdoor entrance	30	22
Casual assembly work	200	25
Rough/heavy work	300	28
Medium assembly work	500	25
Fine assembly work	1000	22
Precision work	1500	16
General office work	500	19
Computer room	750	16
Drawing office	750	16
Filing room	300	22
Shop counter	500	22
Supermarket	500	22
Classroom	300	16
Laboratory	500	16
Public house bar	150	22
Restaurant	100	22
Kitchen	500	22
Dwellings		
Living / reading / study	50 / 150 / 300	N/A
Kitchen / bedroom / hall	300 / 50 / 150	N/A
Library		
Reading area / tables / counter	200 / 600 / 600	19 / 16 / 16
N/A = not applicable		

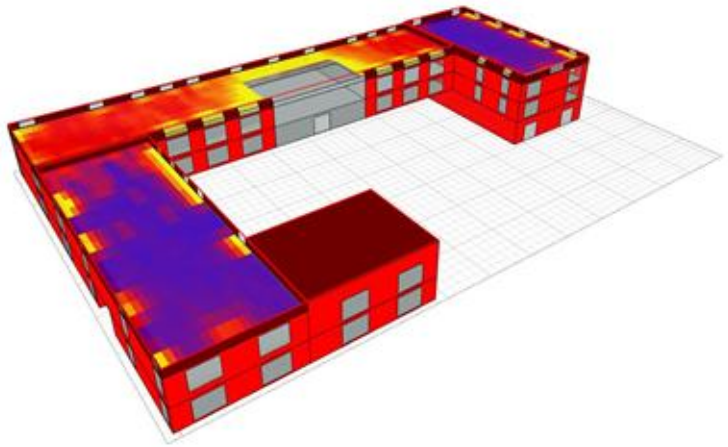
DAYLIGHT CONDITIONS



Classroom	300
Restaurant	100
Kitchen	500
Dwellings	
Living / reading / study	50 / 150 / 300
Kitchen / bedroom / hall	300 / 50 / 150

- General office: 500lux





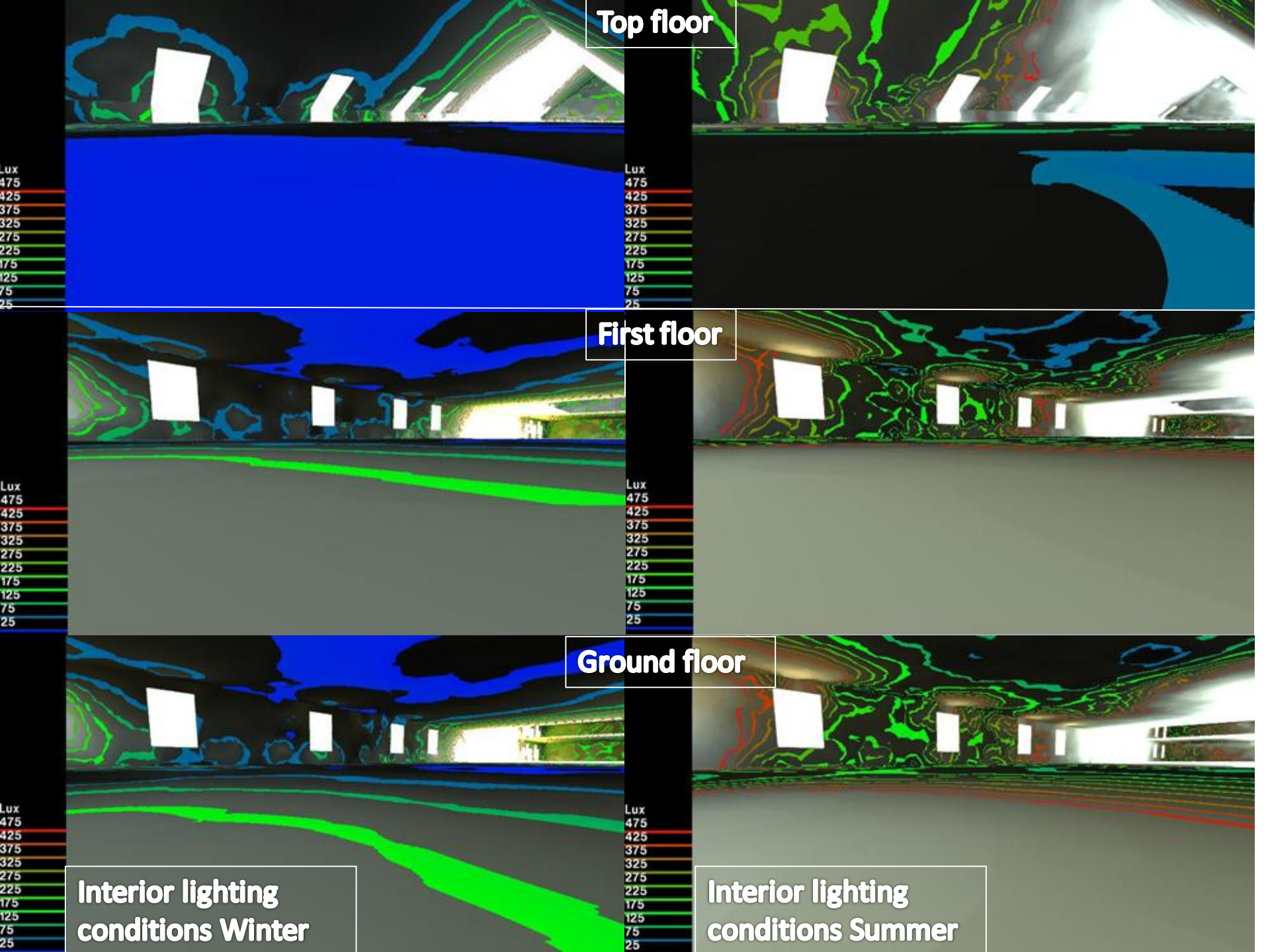
DAYLIGHT CONDITIONS

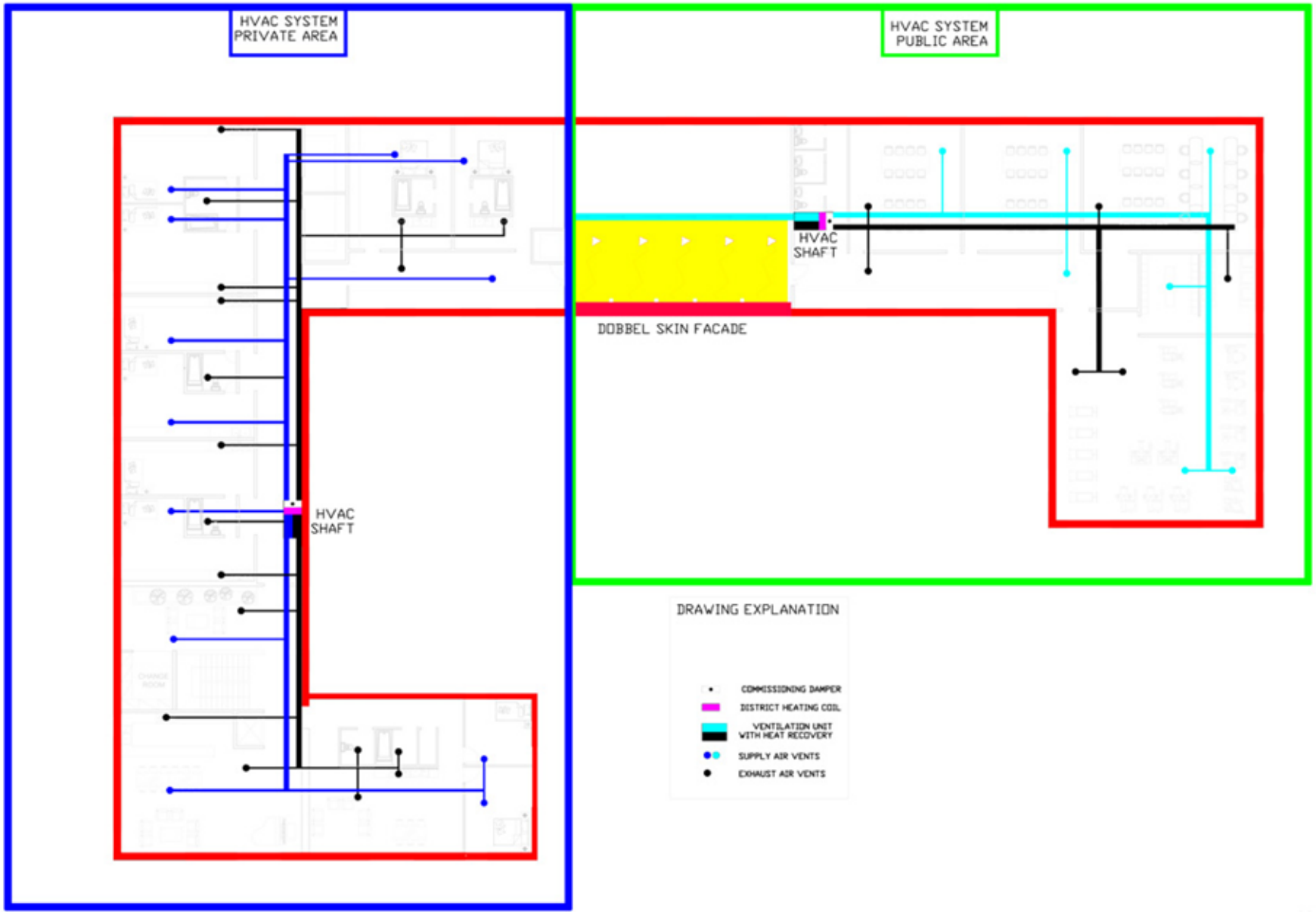
Illumination levels and limiting glare indices for various functions.

- General office: 500lux

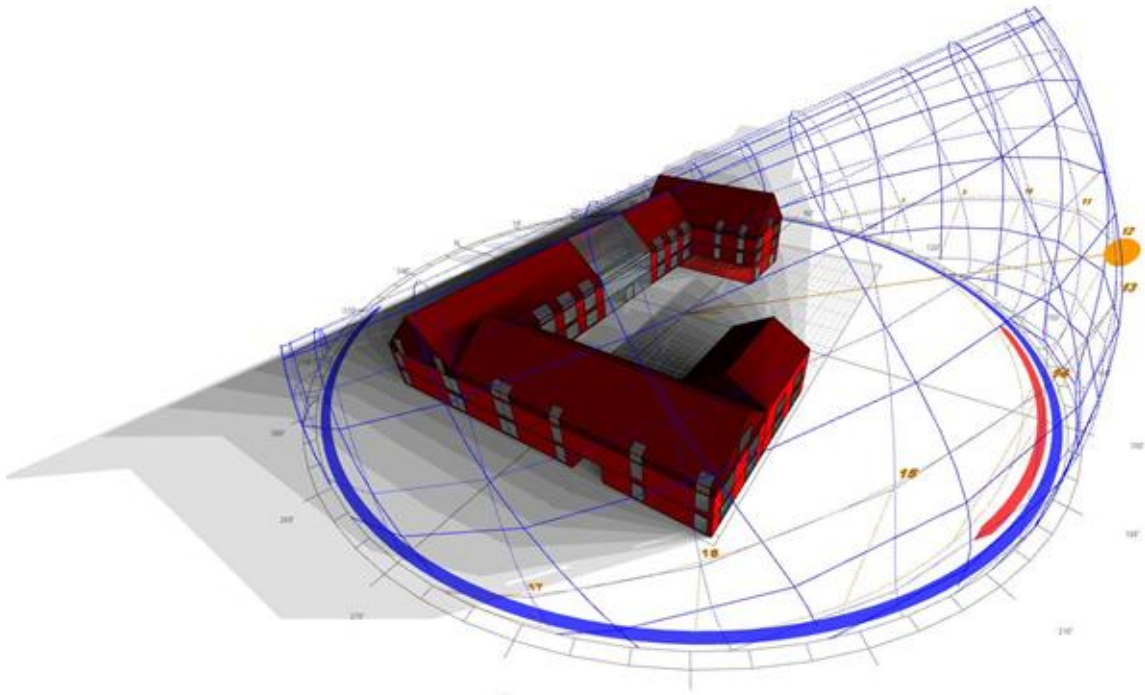
Location	Illuminance (lux or lm/m2)	Limiting glare index
Entrance hall	150	22
Stairs	150	22
Corridor	100	22
Outdoor entrance	30	22
Casual assembly work	200	25
Rough/heavy work	300	28
Medium assembly work	500	25
Fine assembly work	1000	22
Precision work	1500	16
General office work	500	19
Computer room	750	16
Drawing office	750	16
Filing room	300	22
Shop counter	500	22
Supermarket	500	22
Classroom	300	16
Laboratory	500	16
Public house bar	150	22
Restaurant	100	22
Kitchen	500	22
Dwellings		
Living / reading / study	50 / 150 / 300	N/A
Kitchen / bedroom / hall	300 / 50 / 150	N/A
Library		
Reading area / tables / counter	200 / 600 / 600	19 / 16 / 16
N/A = not applicable		

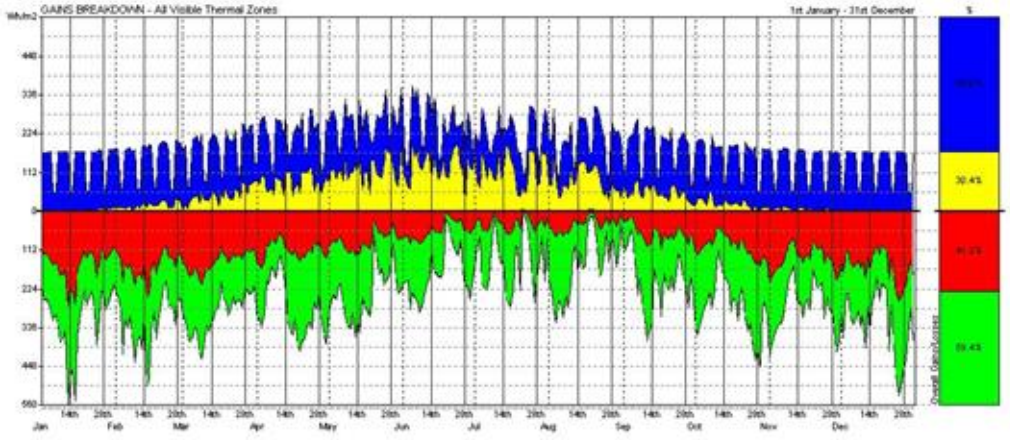
ILLUMINATION LEVELS RECOMMENDATIONS

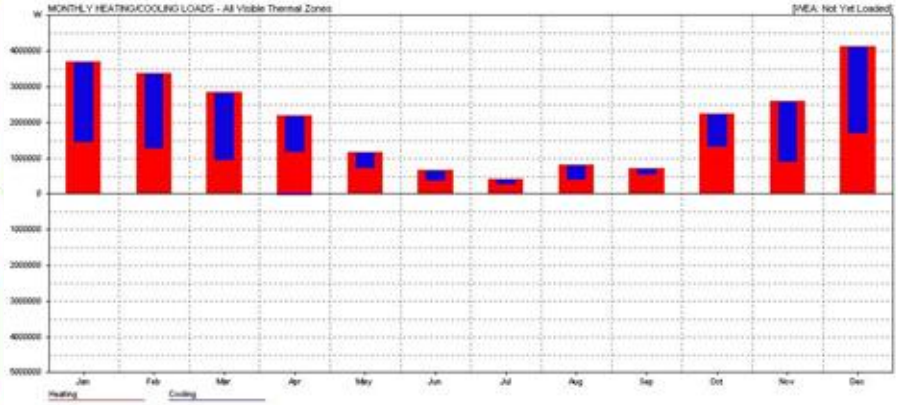

Top floor
First floor
Ground floor
Lux
475
425
375
325
275
225
175
125
75
25
Interior lighting conditions Winter
Interior lighting conditions Summer



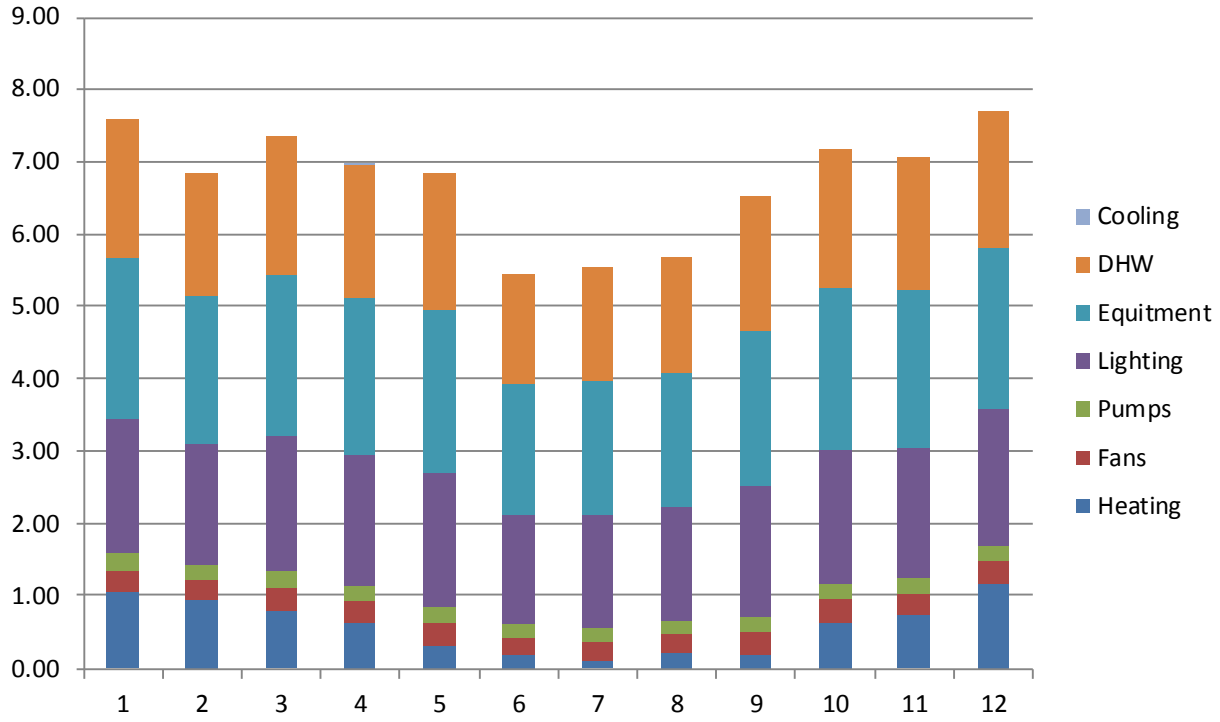
DUCT ROUITNG







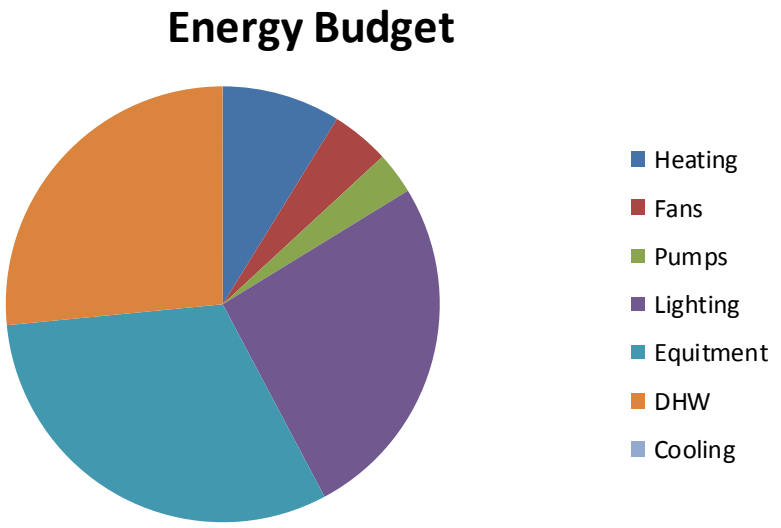
Thermal analysis



Electricity demand = 183 325.27 kWh

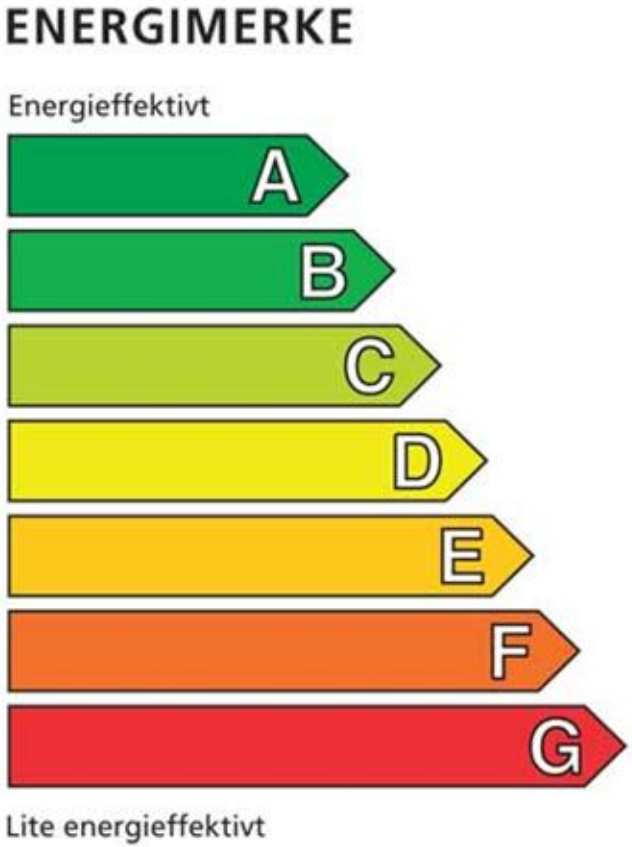
Heat demand = 100 117.42 kWh

-Total energy demand = 283 475.97 kWh



ENERGY DEMAND ECOTECT & NS3031

- Heating
  - Domestic hot water
    - Solar collector 60%
    - District heating 40%
  - Space heating
    - District heating
- Electricity
  - Photovoltaic panels 11%
    - (19 836.00 kWh / 183 325.27 kWh = 11%)



Total delivered energy = <u>247 071.15 kWh</u>

70.31 kWh/m2 < 79 kWh/m2 = Energy label A

DELIVERED ENERGY NS3031 AND ENERGY LABELING 2010

Passive House Verification

Building:	Rotvoll barn Group 05
Location and Climate:	Sør-Trønderlag / N-Trondheim
Street:	Hans Collins vei 5
Postcode/City:	7053 Trondheim
Country:	Norway/Trondheim
Building Type:	Apartment Building
Home Owner(s) / Client(s):	Camphill Norway
Street:	
Postcode/City:	Trondheim
Architect:	Group 05 NTNU Sustainable MSc class
Street:	Alfred Getz vei 3
Postcode/City:	7491 Trondheim
Mechanical System:	oeb Dipl.-Ing. Norbert Starz
Street:	Bahnhofstr. 49
Postcode/City:	D-64319 Pfungstadt
Year of Construction:	2012
Number of Dwelling Units:	33
Enclosed Volume V_e:	6424.5 m³
Number of Occupants:	100.4
Interior Temperature:	20.0 °C
Internal Heat Gains:	0.0 W/m²

No Standard Climate

Calculation Electricity / Internal Heat Gains

Building Type: Residential

Internal Heat Gains

Utilisation Pattern: Other

Type of Values Used: User Determined:

Fill in in IHG worksheet!

Planned Number of Occupants:

75 Verification

Verification: Monthly Method

Specific Space Heat Demand, Annual Method	15.3
Specific Space Heat Demand, Monthly Method	15.2

Specific Demands with Reference to the Treated Floor Area

Treated Floor Area: 3514.0 m²

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	15	kWh/(m²a)	15 kWh/(m²a)	Yes
Pressurization Test Result:	0.6	h⁻¹	0.6 h⁻¹	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	60	kWh/(m²a)	120 kWh/(m²a)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	25	kWh/(m²a)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kWh/(m²a)		
Heating Load:		W/m²		
Frequency of Overheating:	0	%	over 25 °C	
Specific Useful Cooling Energy Demand:		kWh/(m²a)	15 kWh/(m²a)	
Cooling Load:		W/m²		

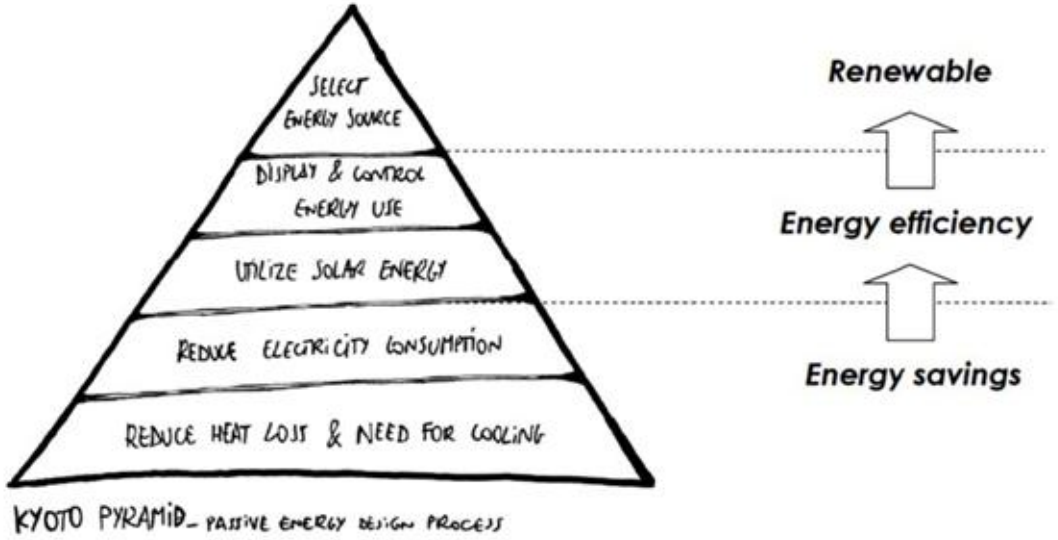
PASSIVE HOUSE PLANNING PACKAGE, OTHERS

PASSIVE HOUSE REQUIREMENTS	value
U-value external wall	≤0.15 W/(m²K)
U-value roof	≤0.13 W/(m²K)
U-value floor	≤0.15 W/(m²K)
U-value window	≤0.80 W/(m²K)
U-value door	≤0.80 W/(m²K)
Normalized thermal bridge- value	≤0.03 W/(m²K)
Yearly mean temperature efficiency for the heat recovery unit	≥80 %
SFP- factor ventilation system[1]	≤1.5 kW/(m³/s)
Leakage number when 50 Pa, n_{50}	≤0.6 h^{-1}

THEORETICAL ARCHIVED VALUES	Walls	U ≤ 0.10 W/m²K
Exterior to ambient		U = 0.099 W/m²K
Exterior to ground		U = 0.097 W/m²K
Roof		U = 0.1 W/m²K
Floor		U = 0.099 W/m²K
Windows		
	Glazing, U-value	U = 0.70 W/m²K
	Frame, U-value	U = 0.70 W/m²K
	g-value	0.50
Summer Shading		
	South façade	90%
	West, East facades	50%
Heating & Ventilation		
	District heating	22.2 kWh/ m²a
	Heat recovery unit efficiency	88%
	Solar DHW fraction	15%
	Electricity demand for appliances	14.4 kWh/ m²a

NORWEGIAN PRODUCTS	Producer	Name
Solar collector	Velux	U12 and S08
Photovoltaic (not Norwegian)	Sharp / PowerView	NU-U235F1/Smart Glass
Windows	Nordan	Tech 0.7
Door	Nordan	Tech 0.7
Skylight	Velux	GPU/GPL
Water tank	OSO	Maxi buffer 17RB
Material	Manufactory	Name
Wall/roof Insulation	Glava	EXTREM 33 PLATE
Floor Insulation	Glava	EPS S 150
Vapor barrier	Isola	SD5 Dampbrems
Wind barrier	Isola	Soft Vindsperre

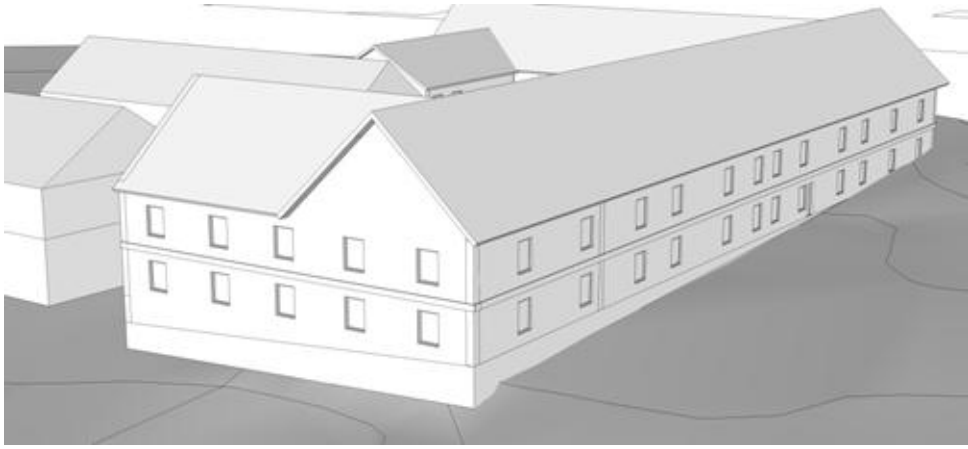
PH REQUIREMENTS, THEORETICAL ACHIEVED VALUES AND PRODUCTS



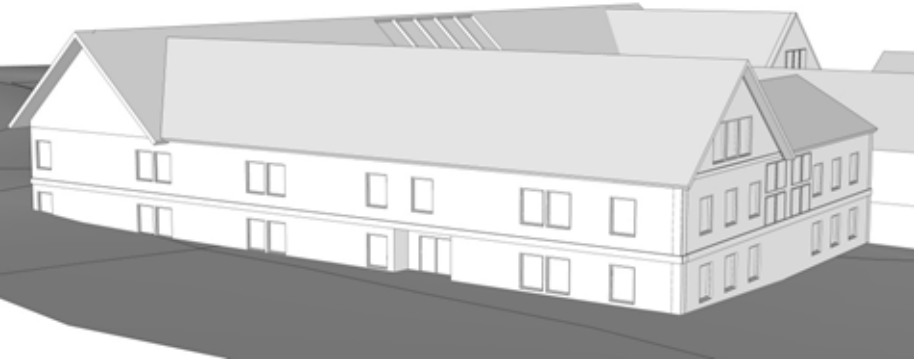
KYOTO PYRAMID_ PASSIVE ENERGY DESIGN PROCESS

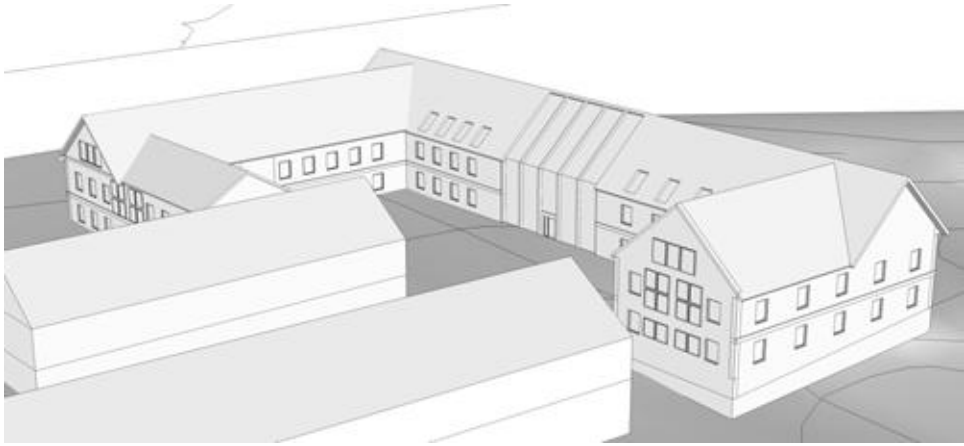
CONCLUSION

PV Panels and solar collectors on the south elevation.



Atrium and double skin façade in the south.





3D MODELING OF THE PROJECT