

Integrated Energy Design (IED) - AAR4616/AAR4926

Refurbishment of Camphill ROTVOLL



Group #3
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1. CONCEPT

- a. Reuse of both structure and façade
- b. Improve (thermal zone & buffer space)

2. ARCHITECTURAL DESIGN

- a. Site plan, plan & section
- b. Elevation
- c. Possibilities of space

3. Detail

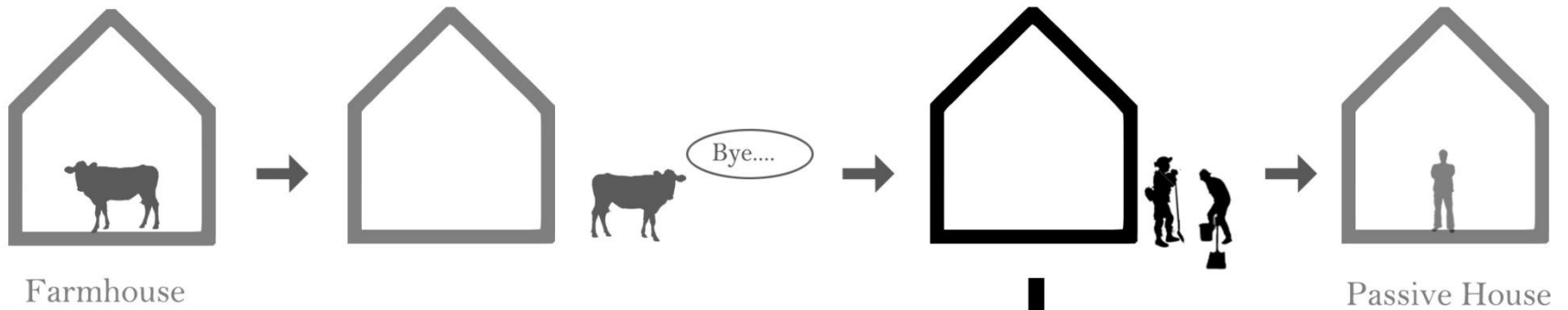
4. TECHNICAL PART

- a. Heat recovery system
- b. Solar thermal collector

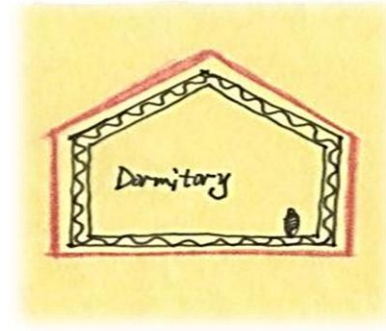
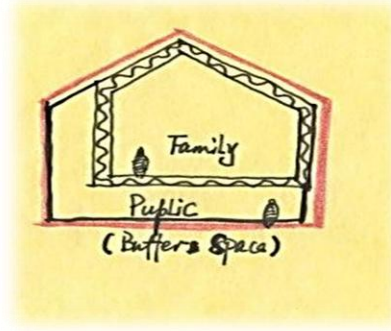
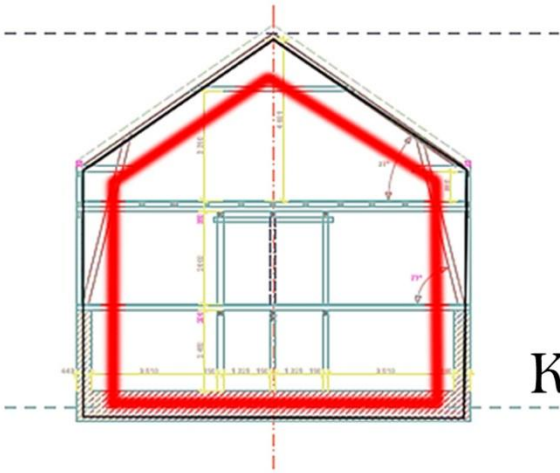
5. DOCUMENTATION of PHPP

1. CONCEPT

CONCEPT



What We Do?
Build A New House In Existing House



Keep Existing Facade, Build A New House Inside

HOW ?

Reuse & Improve

a. Reuse of facade

- Facade
 - Materials (Keep existing cladding)
 - History (The best display of its own history)
- Structure

Reduce CO2-impact by reducing building materials on site

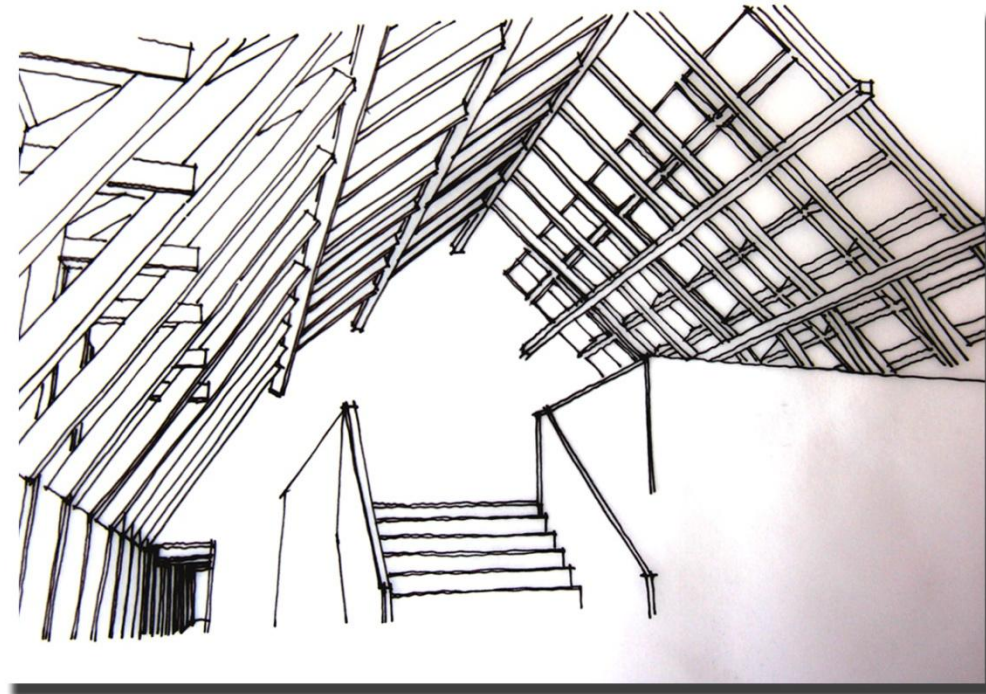
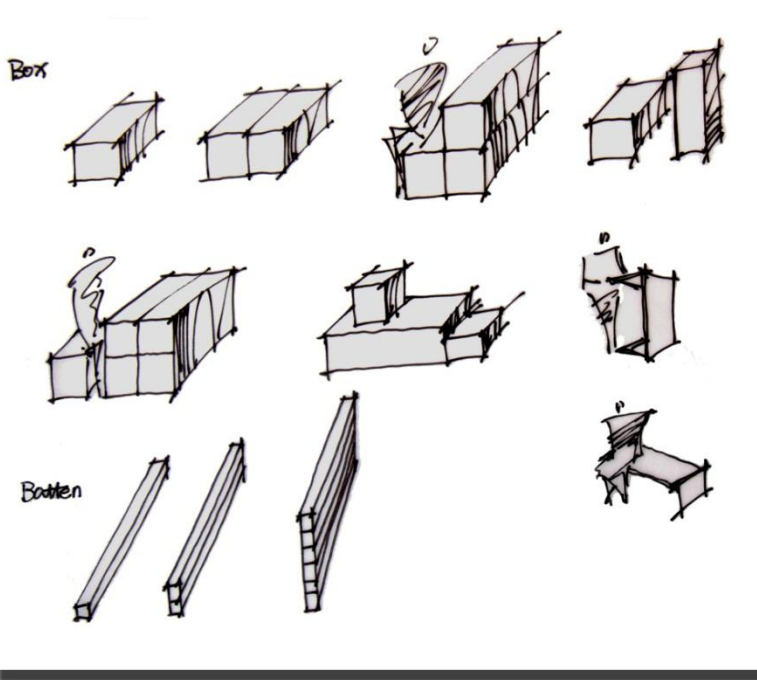


Try to preserve most of the old parts as much as we can



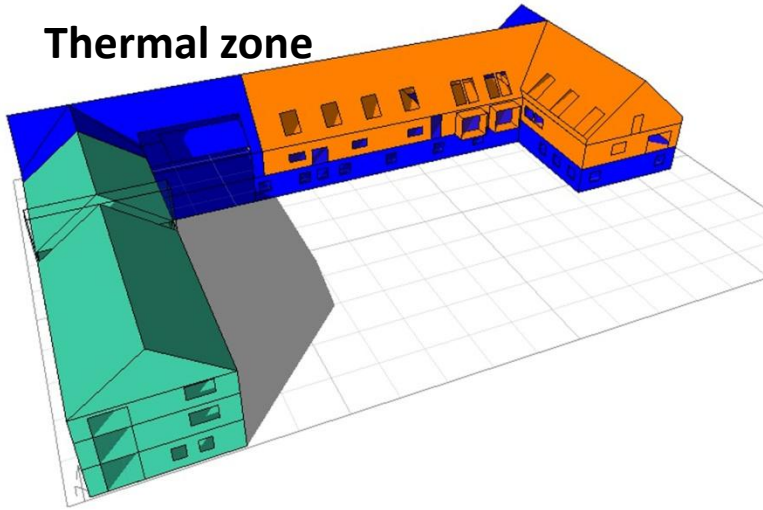
a. Reuse of structure


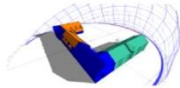

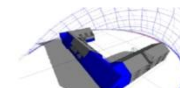

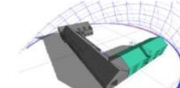
- Structure
 - Materials (Reuse the wood to build some furnitures)
 - History (Display old structure in main public space)



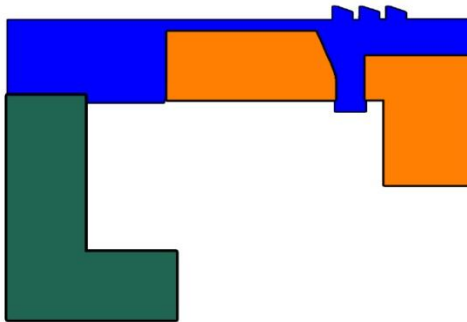
b. improvement

Thermal zone

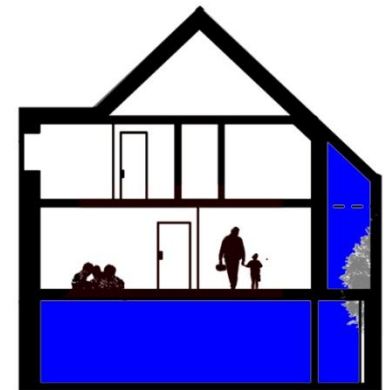
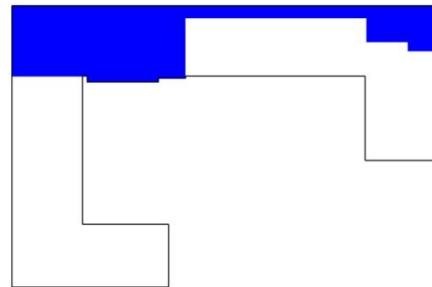


	LOCATION	AREA	THERMAL REQUIREMENT	OPERATION TIME
Family part 		695.3 m ²	23	4:00pm To 8:am (Mon. to Fri)
Shared big space 		778 m ²	18	8:00am To 4:00pm (Mon. to Fri.)
Dormitory part 		816.5 m ²	23	4:00pm To 8:am (Mon. to Fri)

N



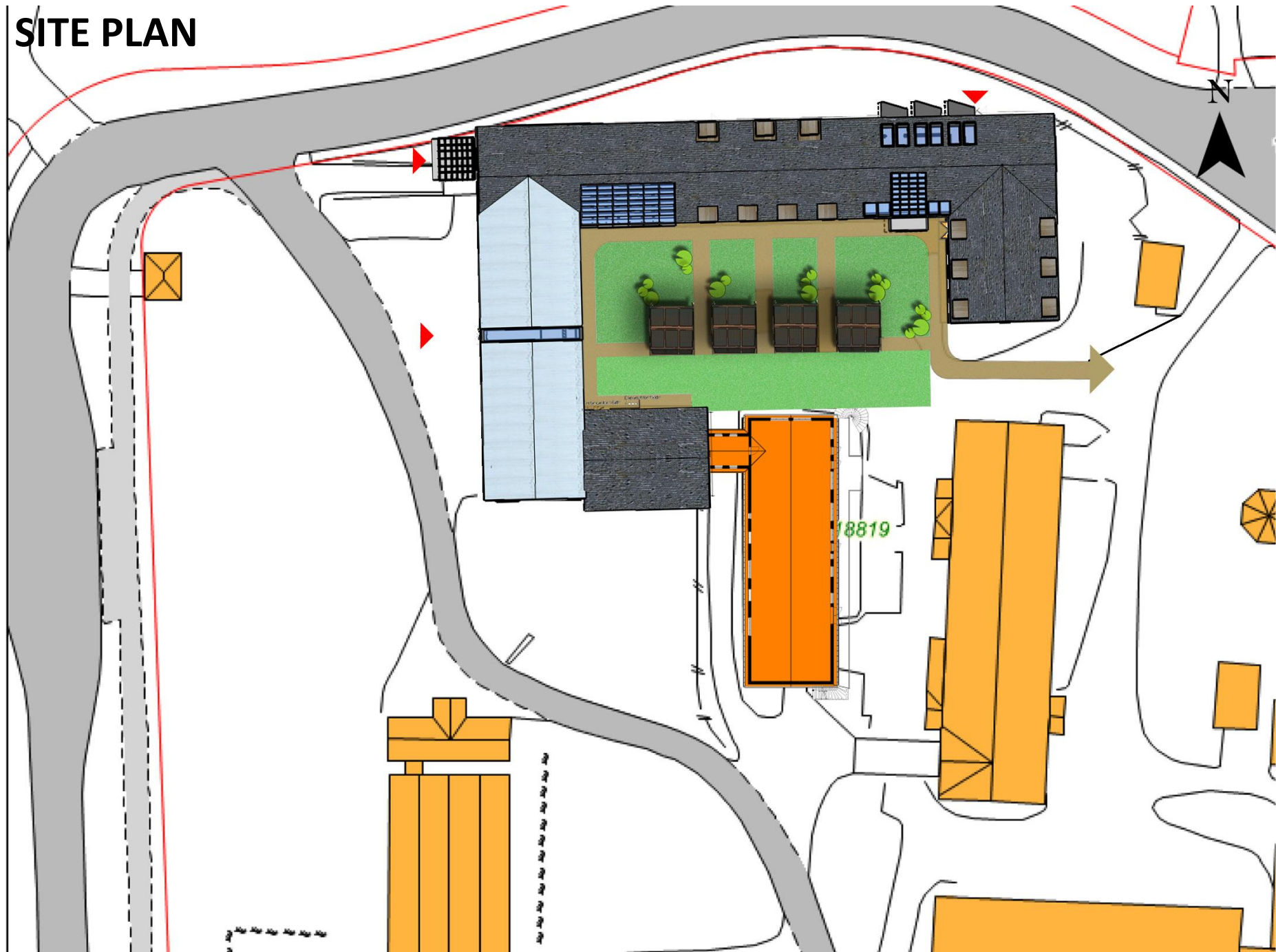
Buffer space



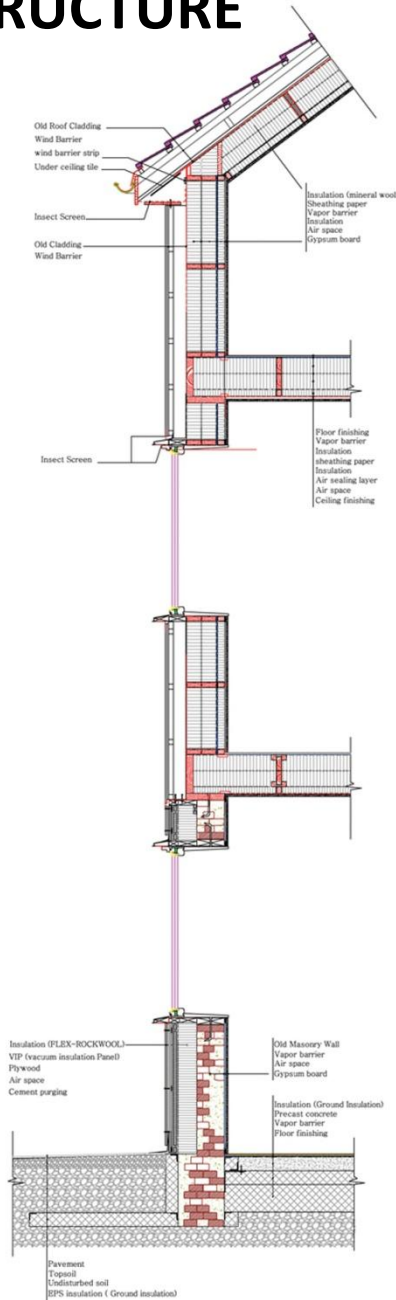
2. ARCHITECTURAL DESIGN



SITE PLAN



DETAILS & STRUCTURE



THERMAL ZONE - 1PUBLIC AREA
 KEEPING THE OLD STRUCTURE AS VISUAL AND CULTURAL ELEMENT
 REUSING OLD MATERIALS TO MAKE NEW FURNITURE FOR LIVING ROOM
 LIGHT INSULATION
 AIRTIGHT ENVELOPS
 HEATING FROM THE REFRESHING THE EXHAUSTED AIR FROM ROOMS
 BIG FIRE PLACE / HEATING RECOVERY

THERMAL ZONE - 2DORMITORY
 HIGH INSULATION
 AIRTIGHT ENVELOPS
 NEW STRUCTURE
 NATURAL VENTILATION THROUGH THE OLD PASSAGE
 HEATING FROM THE REFRESHING THE EXHAUSTED AIR FROM ROOMS

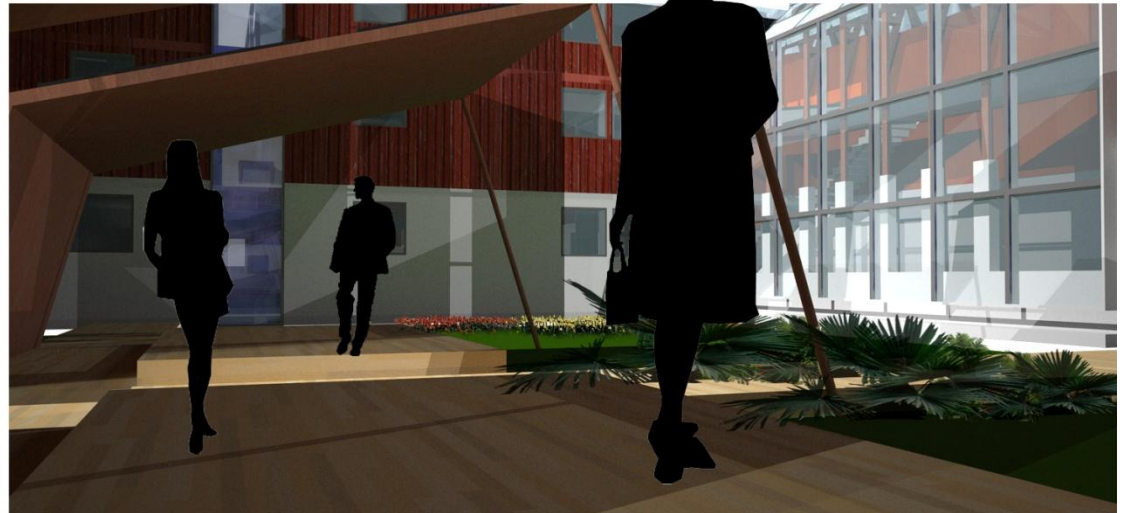
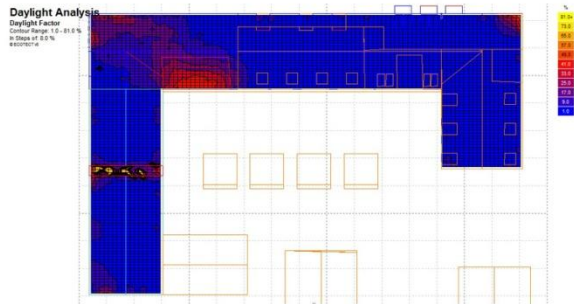
THERMAL ZONE - 3FAMILY UNITS
 HIGH INSULATION
 MODERATE INSULATION IN NORTH ENVELOP
 BUFFER SPACE IN NORTH SIDE



1ST FLOOR



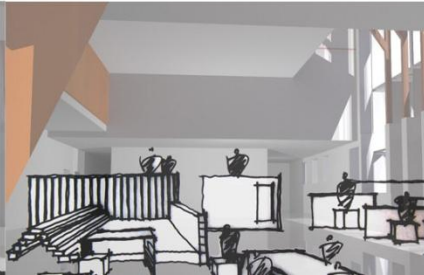
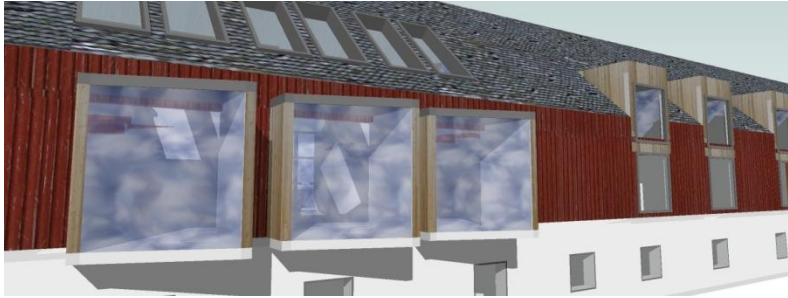
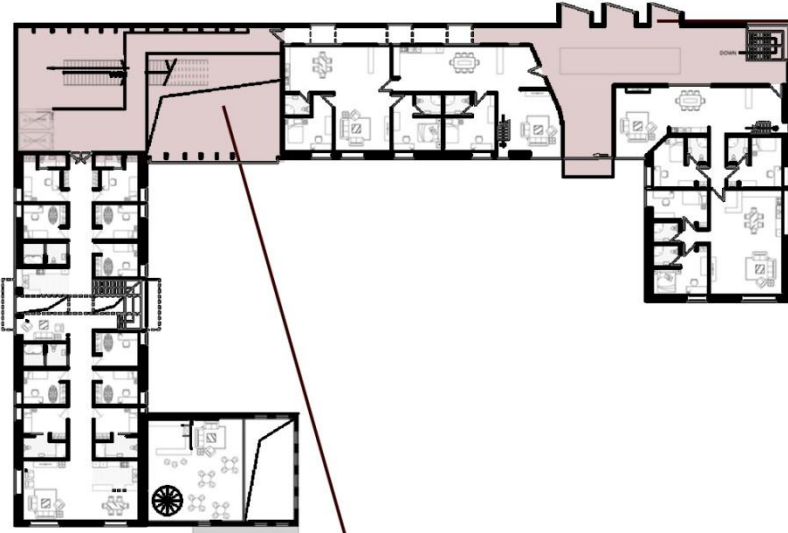
- Public space
- Dormitory
- Family
- Corridor & circulation



2ND FLOOR



Possibilities of space

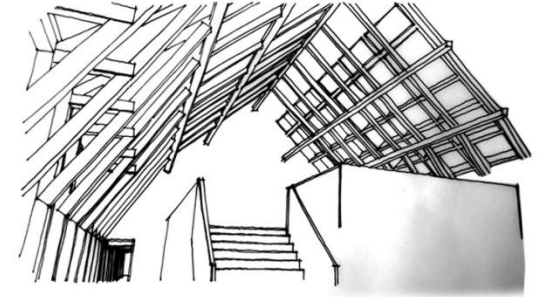
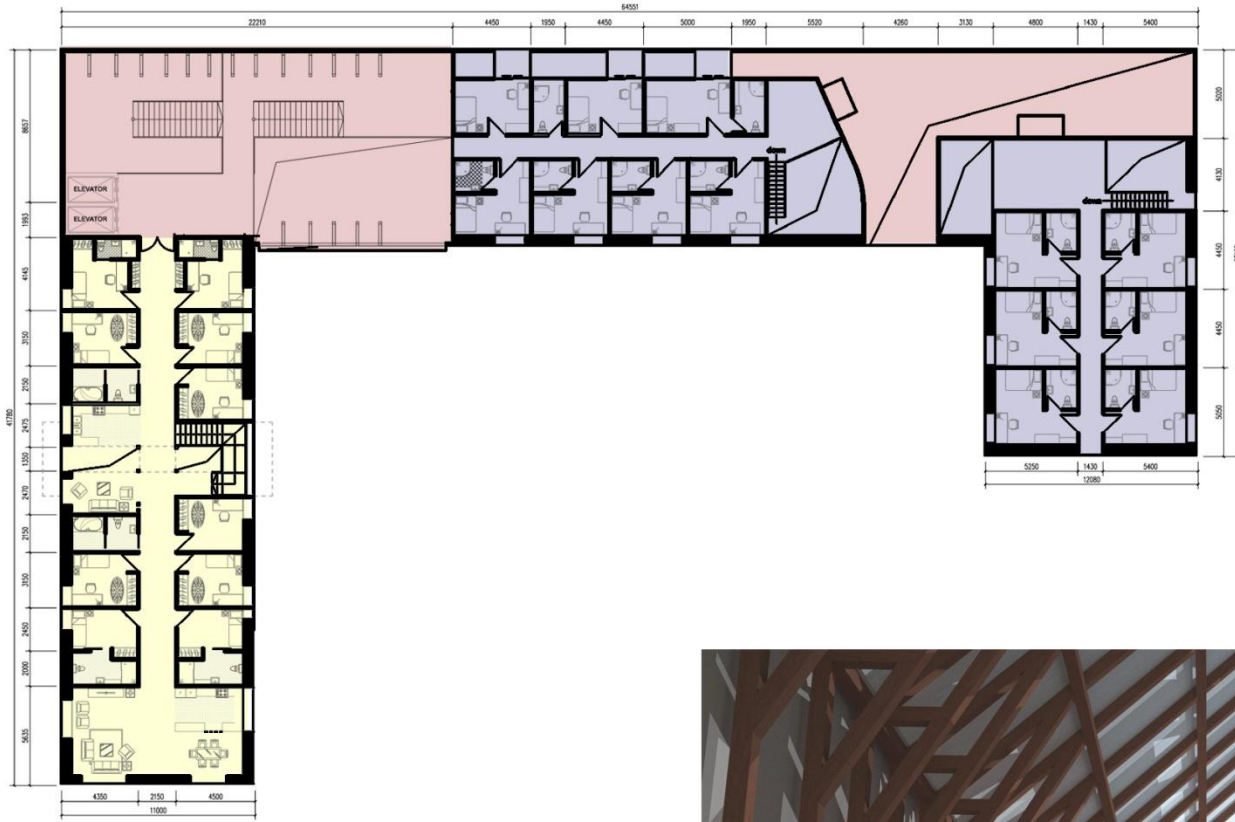






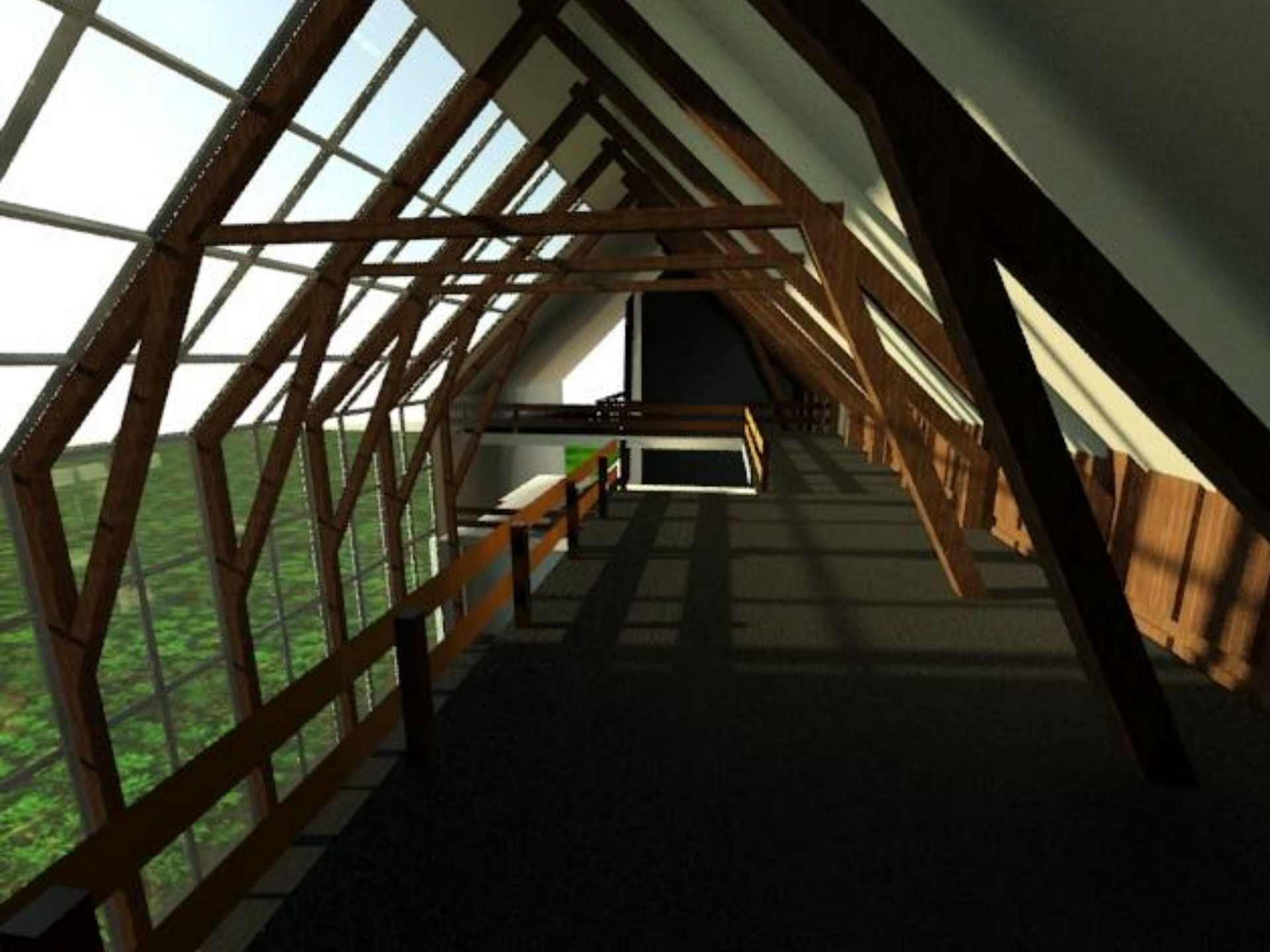


3RD FLOOR

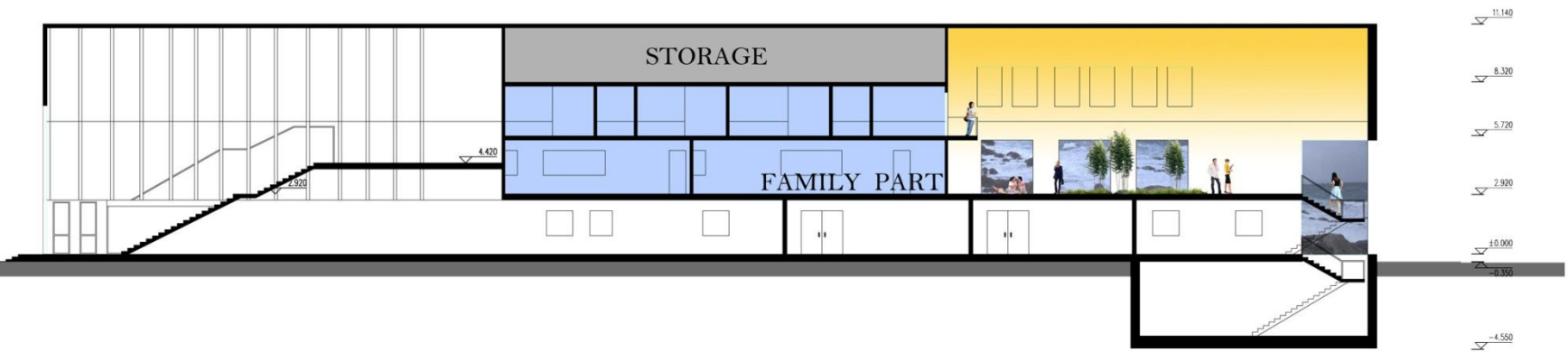
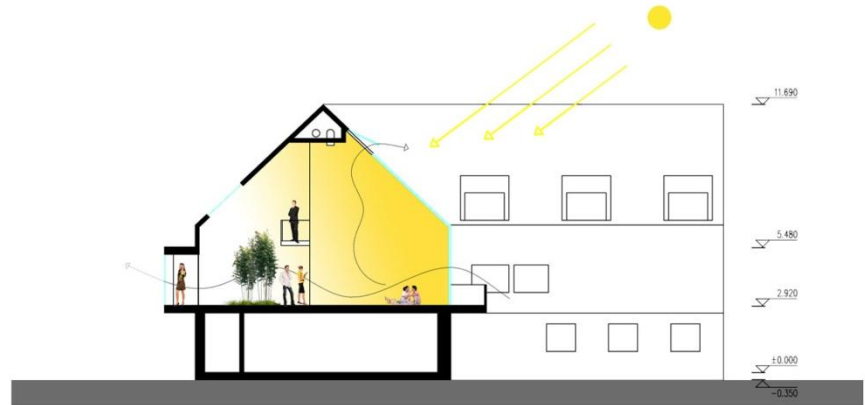
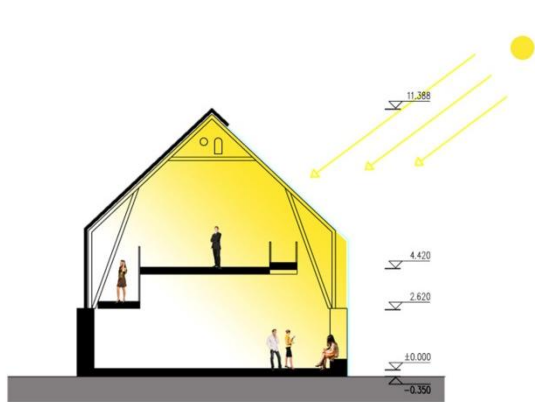


Lighting Analysis





SECTION AND ELEVATION





NORTH FACADE



SOUTH FACADE

3. STRATEGIES

VENTILATION

STACK EFFECT IN BUFFER SPACE
DRAW UP AIR FROM GROUND FLOOR.
SINGLE-SIDED VENTILATION IN ROOMS

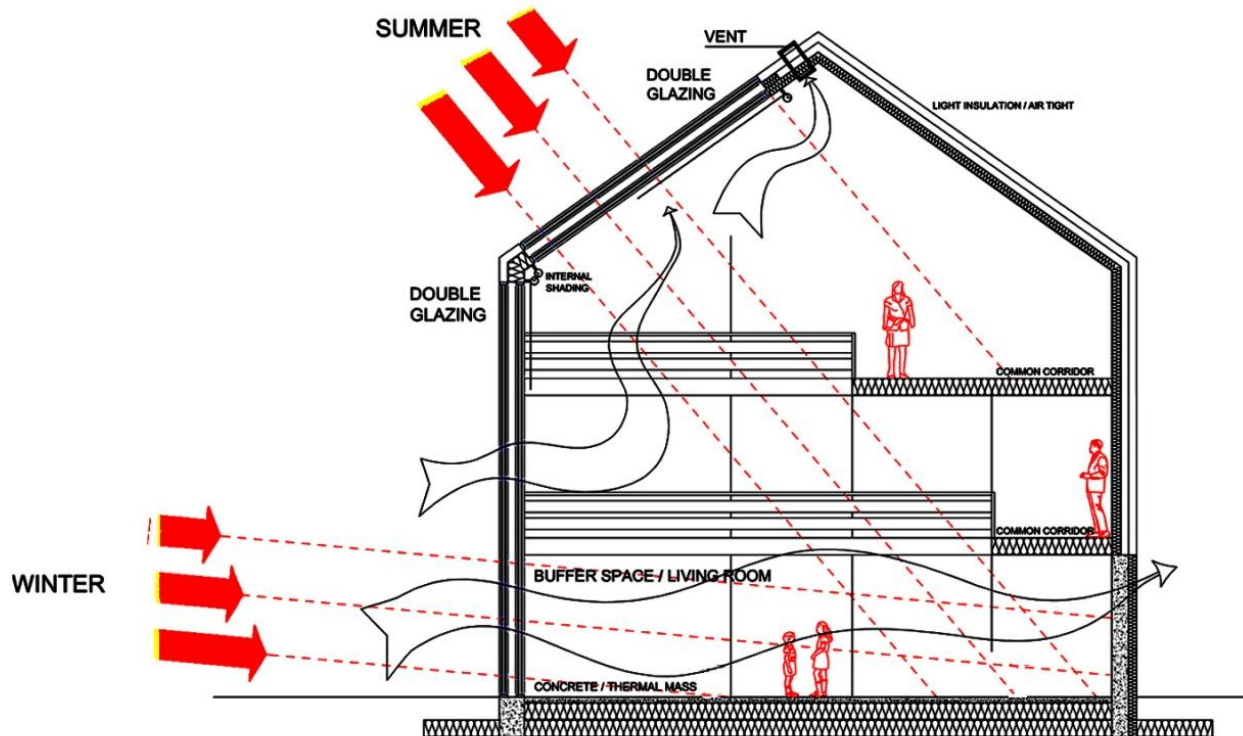
PASSIVE HEATING STRATEGIES

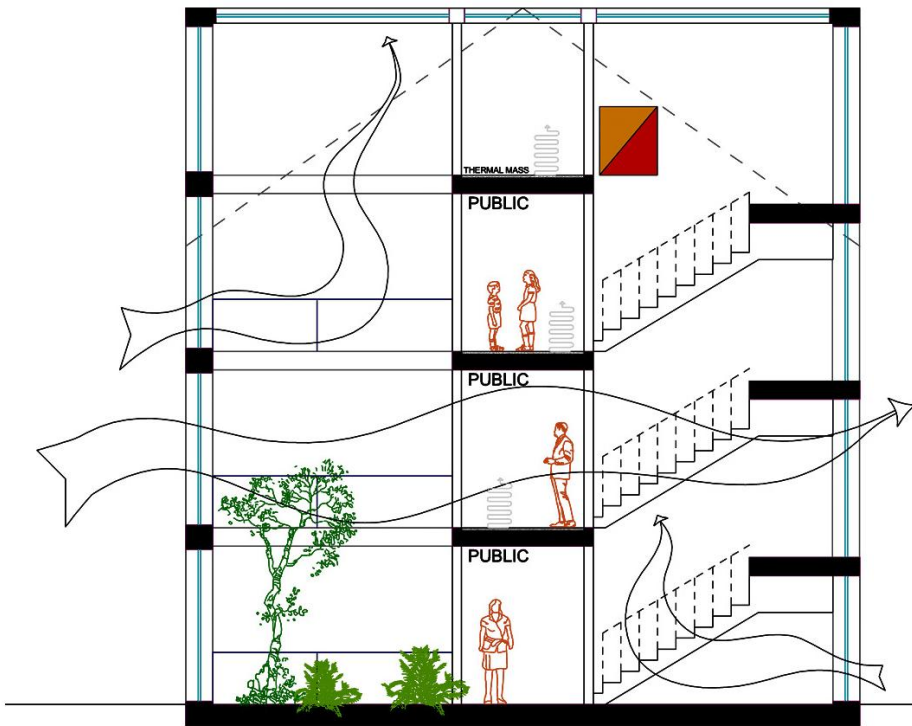
GLAZED SOUTH WALL AND ROOF FOR
BUFFER SPACE INCREASE DIRECT
SOLAR HEAT GAIN
SOLAR RADIATION ACTIVATE THERMAL
MASS TO HEAT UP THE BUFFER SPACE
AND RECOVER HEAT LOSS

ACTIVE HEATING

SOLAR THERMAL COLLECTORS ON
WALLS AND ROOF
HOT WATER TANK IN LOFT
EXHAUSTED AIR FROM ROOMS CAN BE
VENT OUT AND PUT IN AIR CLEANER
AND BLOW INTO PUBLIC AREA.

INTERNAL SHADING ON SOUTH WALL
AND ROOF PREVENT THE SPACE FROM
OVER HEATING AND SUN GLARE AND
ALSO HEAT LOSS THROUGH GLAZED
ENVELOPS
LIGHT INSULATION FOR BUFFER SPACE
TO MAKE ENVELOPS AIR TIGHT
HIGH INSULATION FOR THE OTHER
THERMAL ZONES





VENTILATION

STACK EFFECT IN BUFFER SPACE
 DRAW UP AIR BLOWN IN FROM GROUND FLOOR.
 SINGLE-SIDED VENTILATION
 EXHAUSTED AIR FROM ROOMS CAN BE VENT OUT AND PUT IN AIR CLEANER AND BLOW INTO PUBLIC AREA

PASSIVE HEATING STRATEGIES

GLAZED WALLS AND ROOF FOR BUFFER SPACE INCREASE DIRECT SOLAR HEAT GAIN
 HELP THERMAL MASS TO RECOVER HEAT LOSS
 HEAT LOSS FROM ROOMS IN TWO SIDE OF CORRIDOR HEAT UP THE CORRIDOR
 THERMAL MASS HEATING HEAT UP THE CORRIDOR

ACTIVE HEATING

SOLAR THERMAL COLLECTORS
 HOT WATER TANK IN LOFT

VENTILATION

STACK EFFECT IN BUFFER SPACE
 DRAW UP AIR BLOWN IN FROM GROUND FLOOR.
 SINGLE-SIDED VENTILATION
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PASSIVE HEATING STRATEGIES

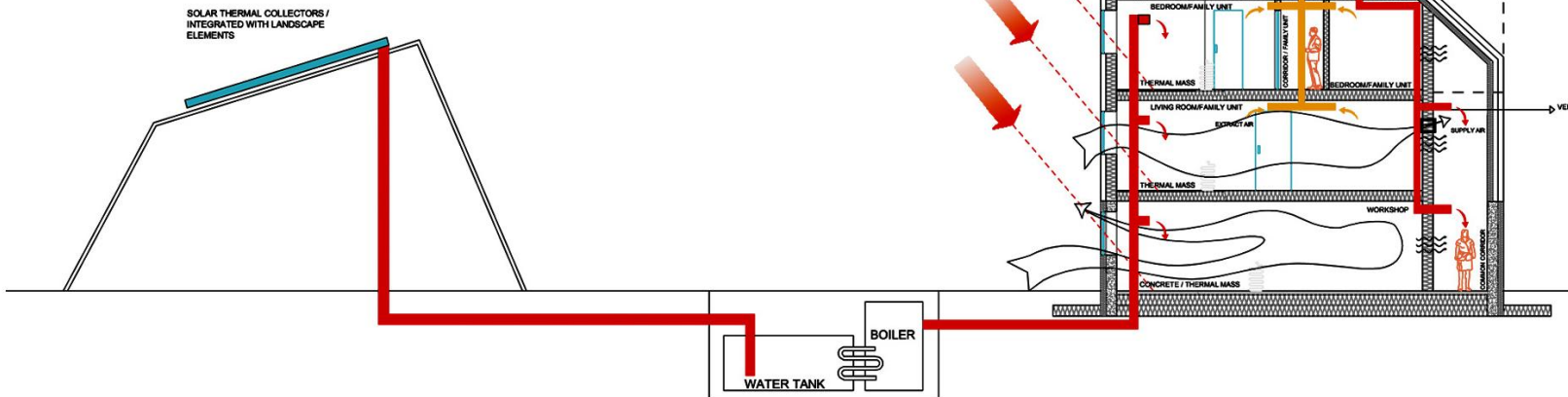
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 HELP THERMAL MASS TO RECOVER HEAT LOSS
 SOLAR RADIATION ACTIVATE THERMAL MASS TO HEAT UP THE BUFFER SPACE

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 HOT WATER TANK IN LOFT

INTERNAL SHADING ON SOUTH WALL AND ROOF PREVENT THE SPACE FROM OVER HEATING AND SUN GLARE AND ALSO HEAT LOSS THROUGH GLAZED ENVELOPS
 LIGHT INSULATION FOR BUFFER SPACE TO MAKE ENVELOPS AIR TIGHT

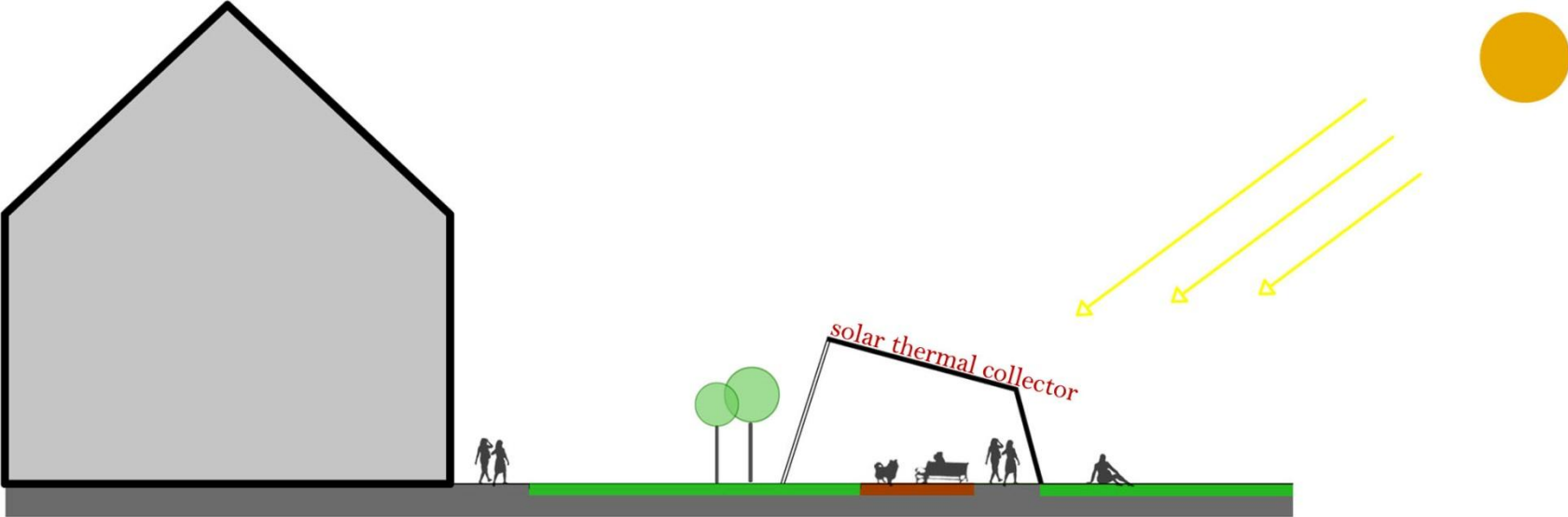
Passive and active strategies in dormitory and family part



4. TECHNICAL PART

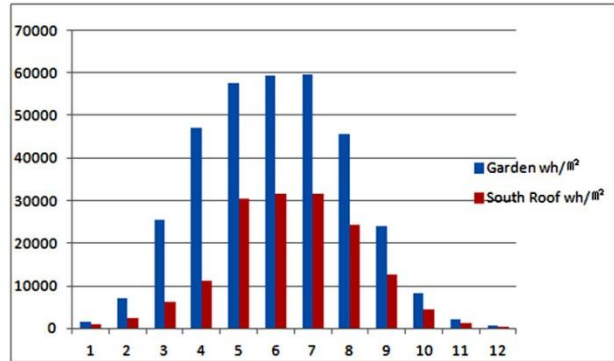
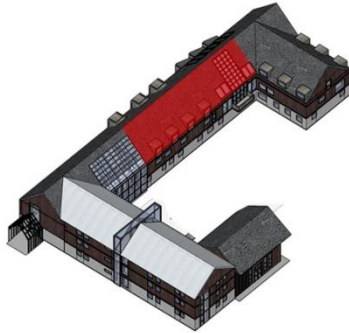
4. Technical part

Solar Thermal Collector

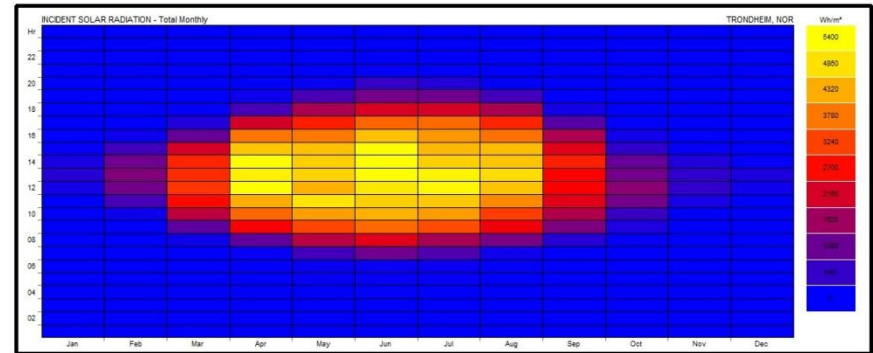
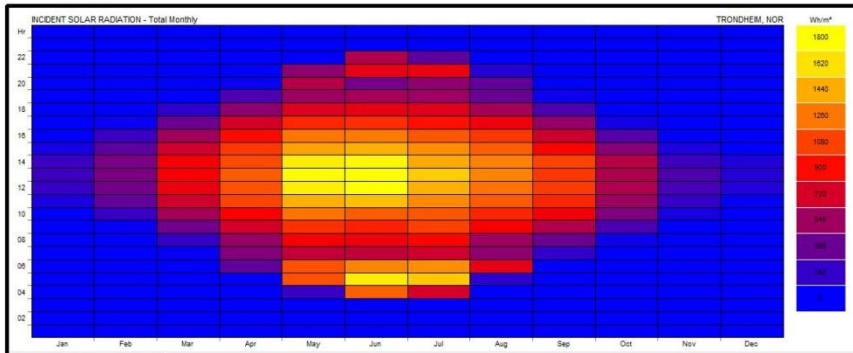
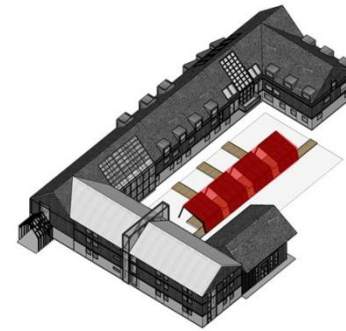


Compare with other possibilities

Southern Roof

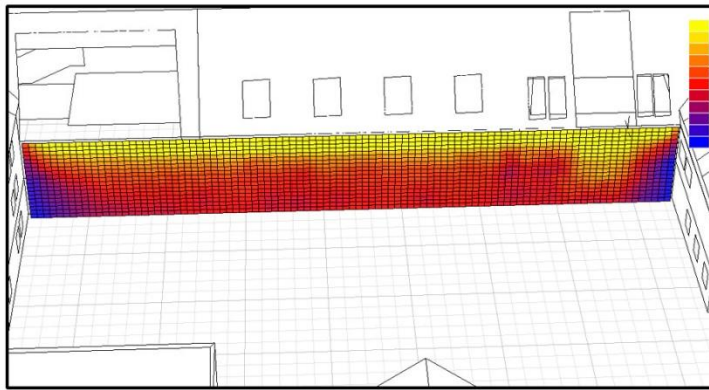


Garden

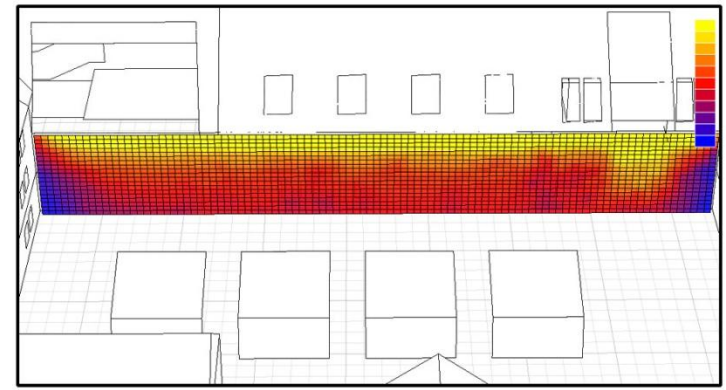


Possible Influence

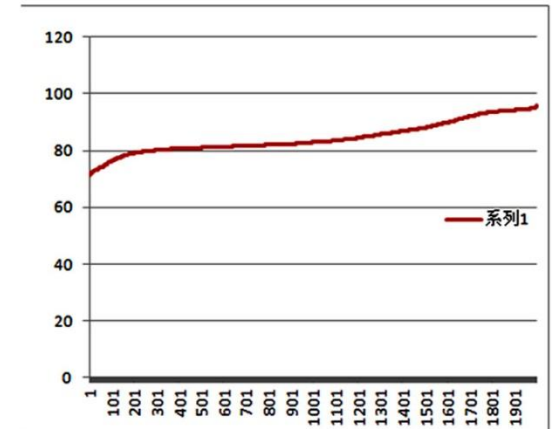
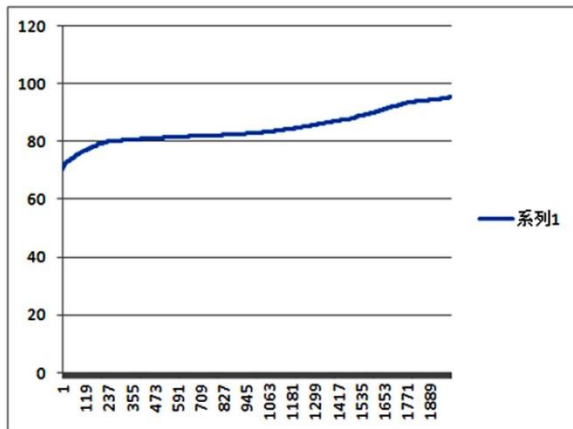
WITHOUT



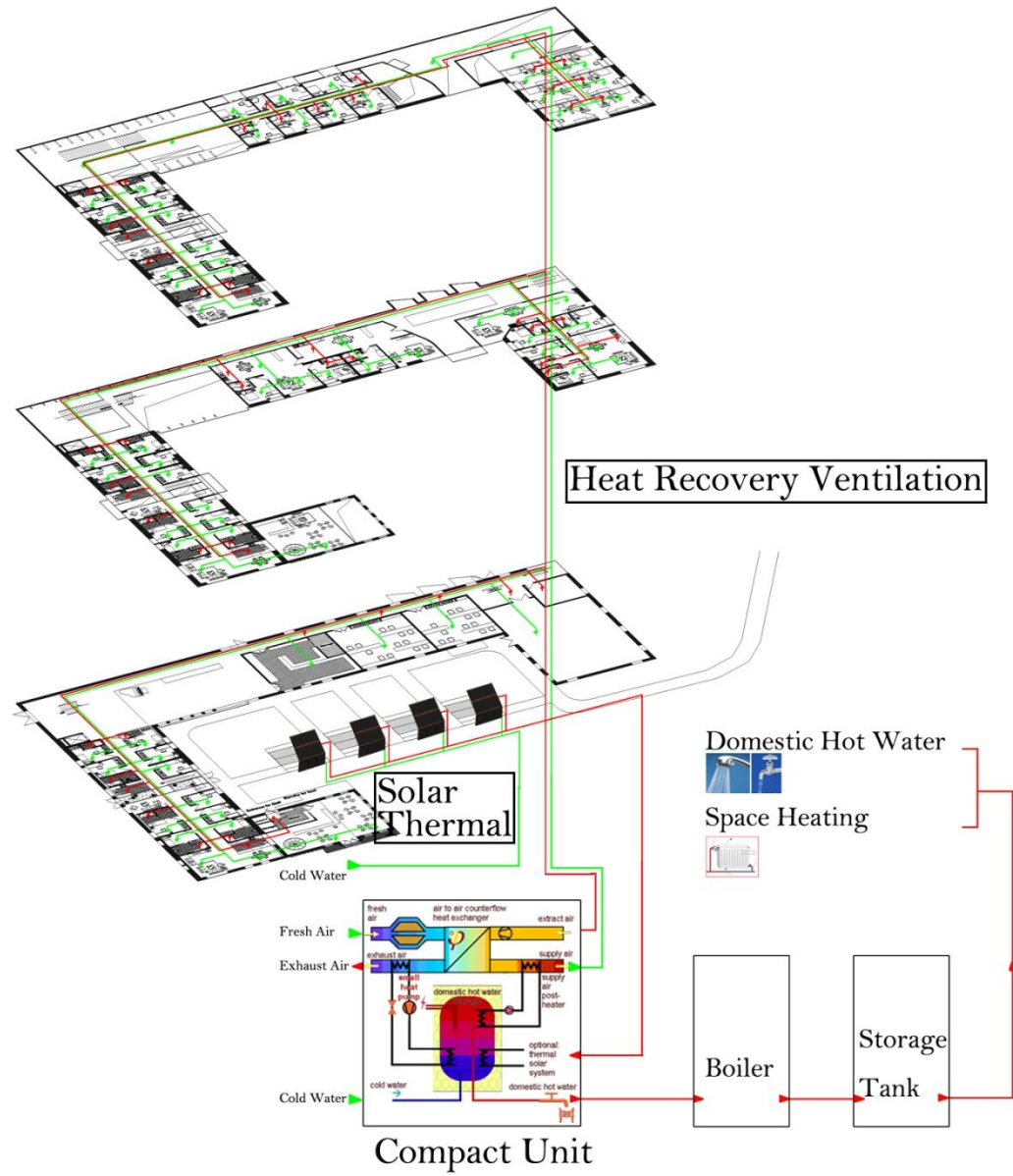
WITH



Solar Access Analysis



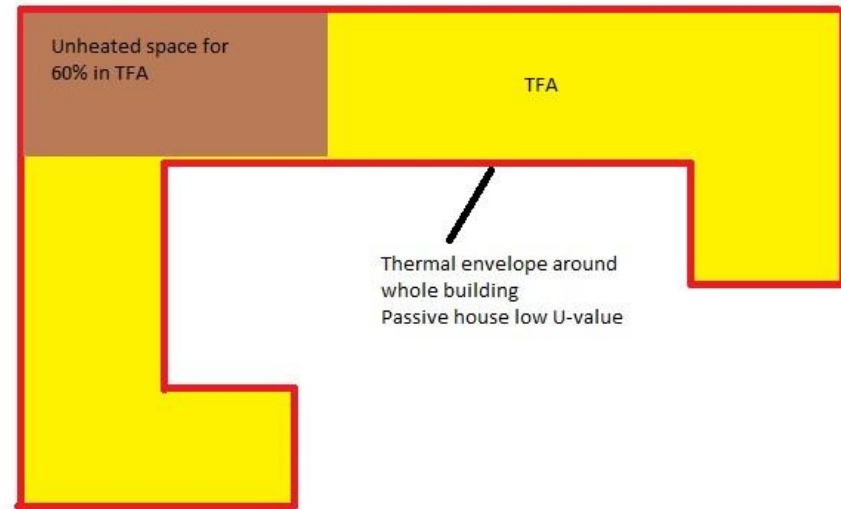
Heating Strategy



5. PHPP DOCUMENT

U-VALUE

Building component	U-value in PHPP [W/m ² K]
Masonry wall (401mm)	0,059
Wooden wall (268mm)	0,128
Roof (268mm)	0,128
Ground floor (415mm)	0,075
Wall heated space – bufferspace	0,167
Wall outside air – bufferspace	0,224



Glazing	Properties
Glazing type	- g-value: 0,5 - U-value: 0,6 W/m ² K
Frame type	- U-value: 0,72 W/m ² K - Frame dimensions: 0,14m (each direction) - Thermal bridge spacer: 0,04 W/mK - Thermal bridge installation: 0,04 W/mK

Installation type	Current choice	Properties
Heat exchanger	<ul style="list-style-type: none"> - Thermos 200 DC – Paul 	<ul style="list-style-type: none"> - Efficiency: 92% - Electrical efficiency: 0,36 Wh/m³
Solar thermal collector	<ul style="list-style-type: none"> - 100m² Vacuum tube collector - Oriented on the south, vertical - Stratified solar thermal collector with DHW heat exchanger 	<ul style="list-style-type: none"> - Contributes for 45% to DHW production (model 1) - Contributes 39388 kWh/a to useful heat (model 1)
DHW distribution system	<ul style="list-style-type: none"> - Pipes inside the thermal envelope 	
Heating distribution system	<ul style="list-style-type: none"> - Pipes inside the thermal envelope 	

Other aspects for quality control	Properties
'Thermal-bridge-free'-construction	In PHPP it is assumed that all building details will have a thermal-bridge-coefficient lower than 0,04 W/mK (measured with exterior dimensions). This is called 'thermal-bridge-free construction'. This quality property asks for good building detailing and construction.
Air tightness	0,6 h ⁻¹
Air change rate	0,5 h ⁻¹
Summer air change rate	Infiltration: 0,5 h ⁻¹ Manual night ventilation: 0,5 h ⁻¹
Shading	In PHPP it is assumed that the wind protection coefficient is moderate (0,07). Besides this it is assumed that there is no extra shading from trees around the house. So, it is important that the existing surroundings stay the same, or the PHPP should be updated.
Primary energy source	In PHPP the final primary energy source is set to 100% district heating.

Specific Demands with Reference to the Treated Floor Area

Treated Floor Area: m²

	Applied:	Annual 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):	56	kWh/(m²a)	120 kWh/(m ² a)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	33	kWh/(m²a)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kWh/(m²a)		
Heating Load:		W/m²		
Frequency of Overheating:	2	%	over <input type="text" value="25"/> °C	
Specific Useful Cooling Energy Demand:		kWh/(m²a)	15 kWh/(m ² a)	
Cooling Load:		W/m²		