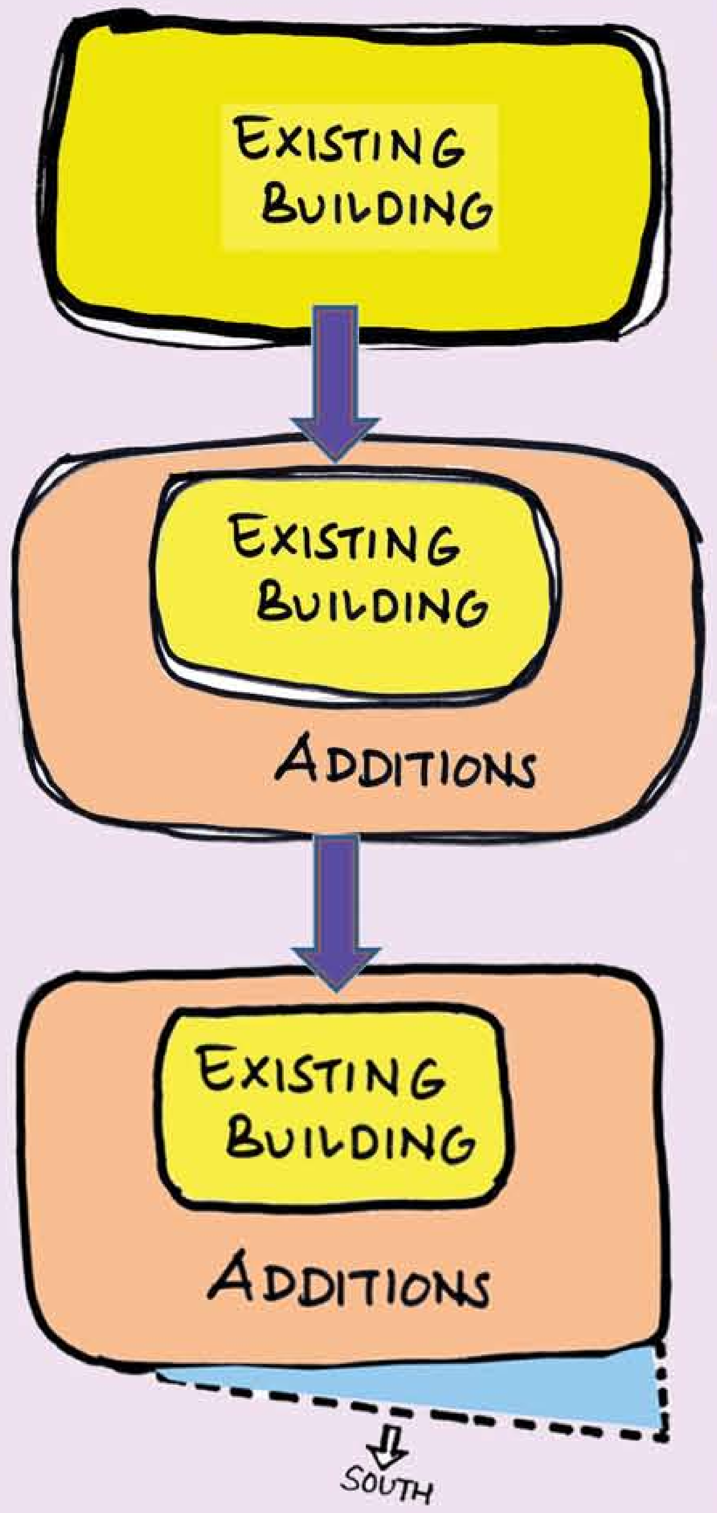
LINESØYA PASSIVE HOUSE

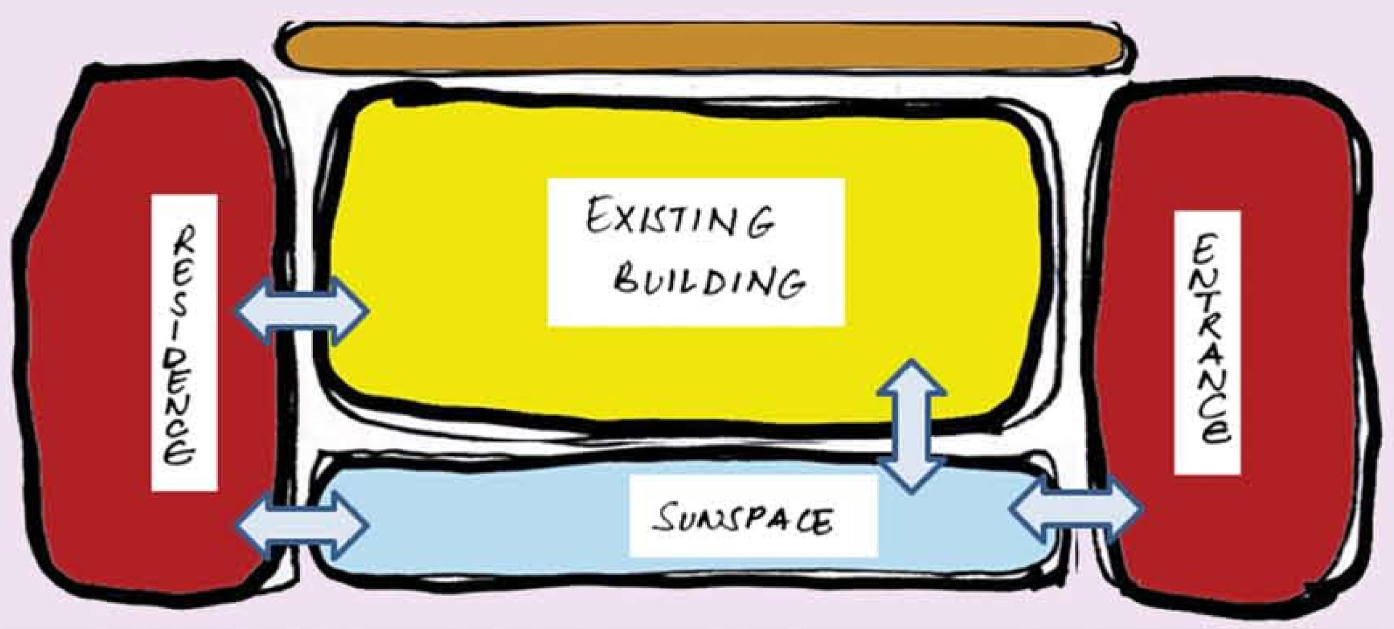
“Cuddling for energy efficiency”

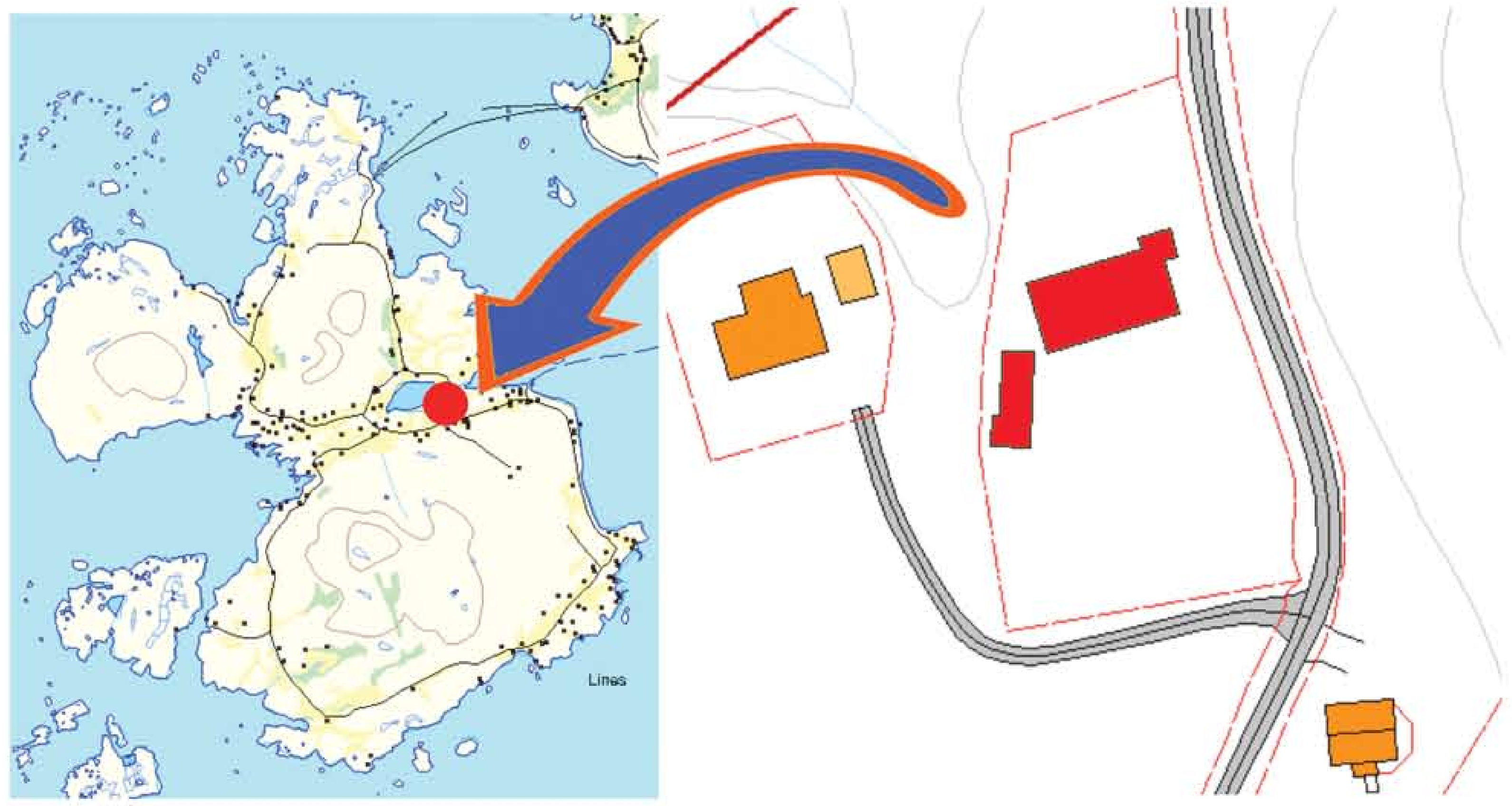
Group 4
Arjun Basnet
Lin Du
Tina Viklund

CONCEPT

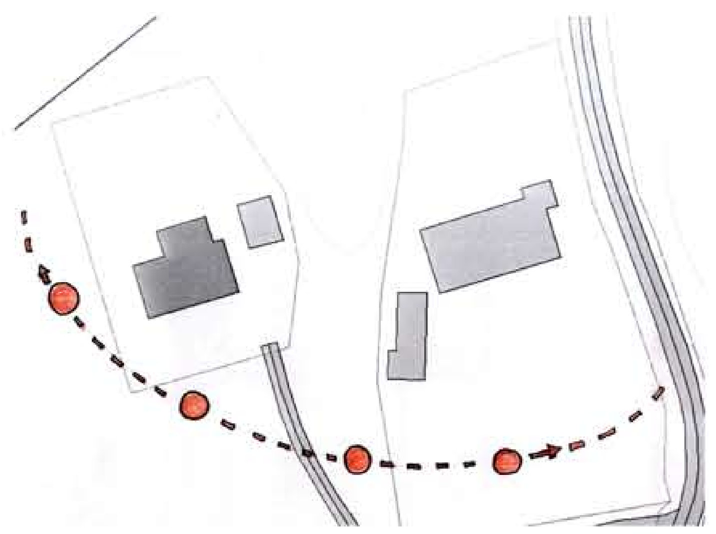


The assigned design project is situated in Linesøya, an island at the Atlantic coast at the end of the Trondheimfjord. Until th construction of the bridge is completed, the island can only be reached by a ferry from the neighboring island Stokøya.The existing building is in fact in a good state even though it has been built back around 1950. Our concept here is to retrofit the house with an envelop of insulation wraping it around to keep it warm as a mother does to her child and we have termed it as cuddling- “cuddling for energy efficiency. There is not much intervention needed. Wrapping it around with extra “layer” could improve its efficiency in terms of energy use.Additions to the south are arranged such that there is ample penetration of sunlight.

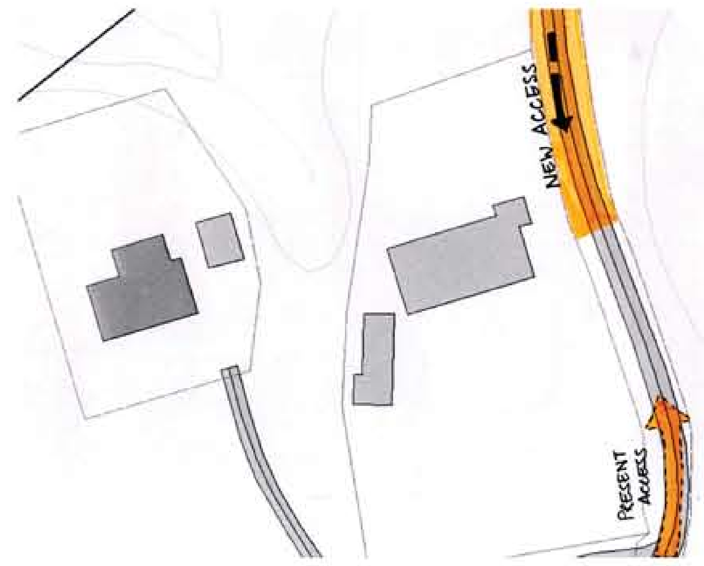




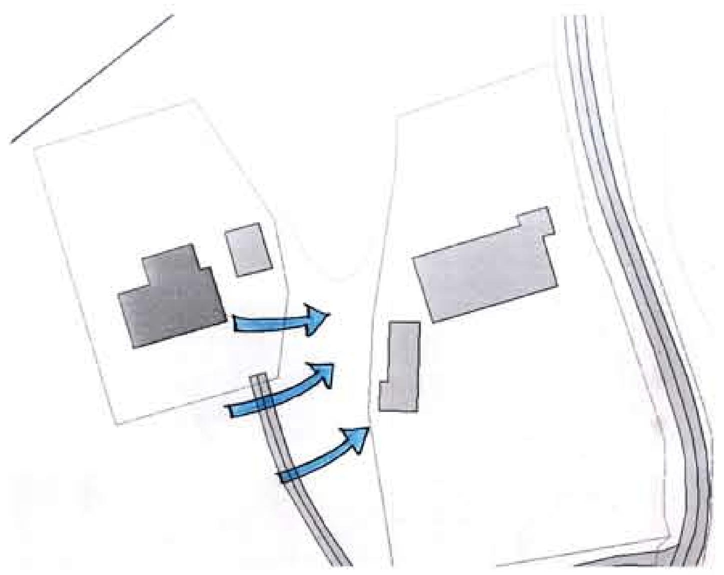
Location



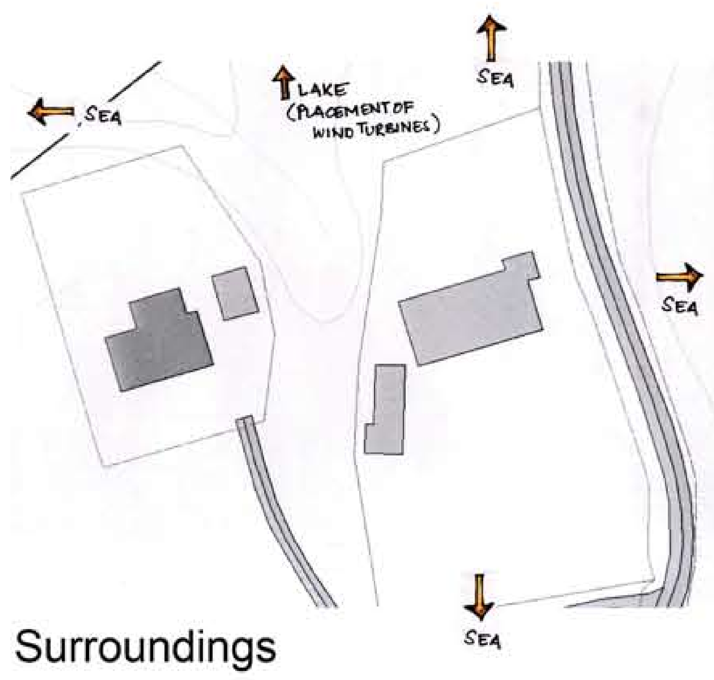
Sun Path



Access



Prevailing wind



Surroundings

SITE

- Access leads the visitors to the parking which is to the south from where one can have a panoramic view of the house.

- Parking is divided into private and public.

- The walkways connect the parking to the building.

- Additions to the original building is done such that maximum sunlight utilized.

- Green areas are retained with further additions.

- The site is articulated as per international design.

- Eco-garden which uses the grey water from the building is to the north.

Site Plan
Sale- 1:200

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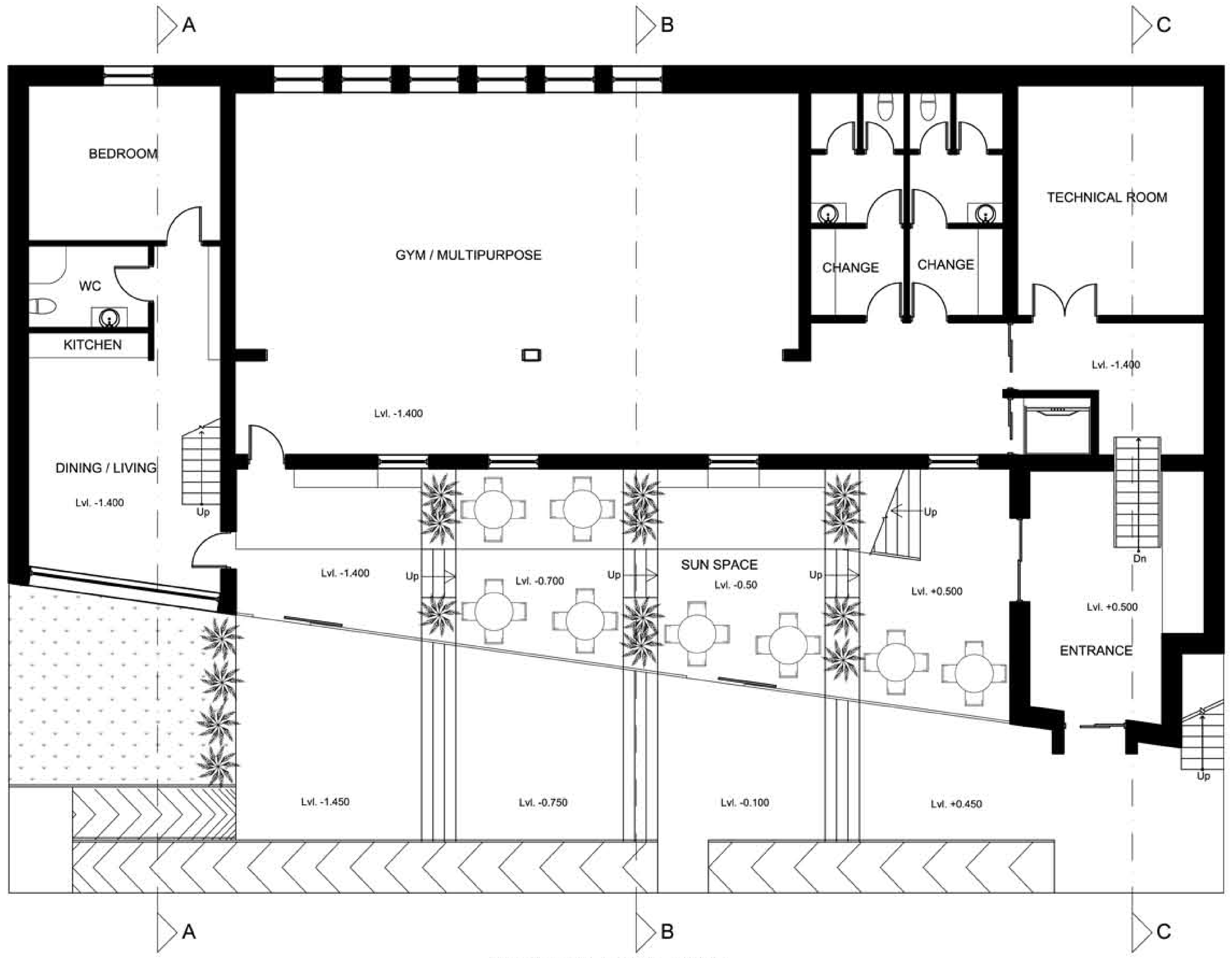
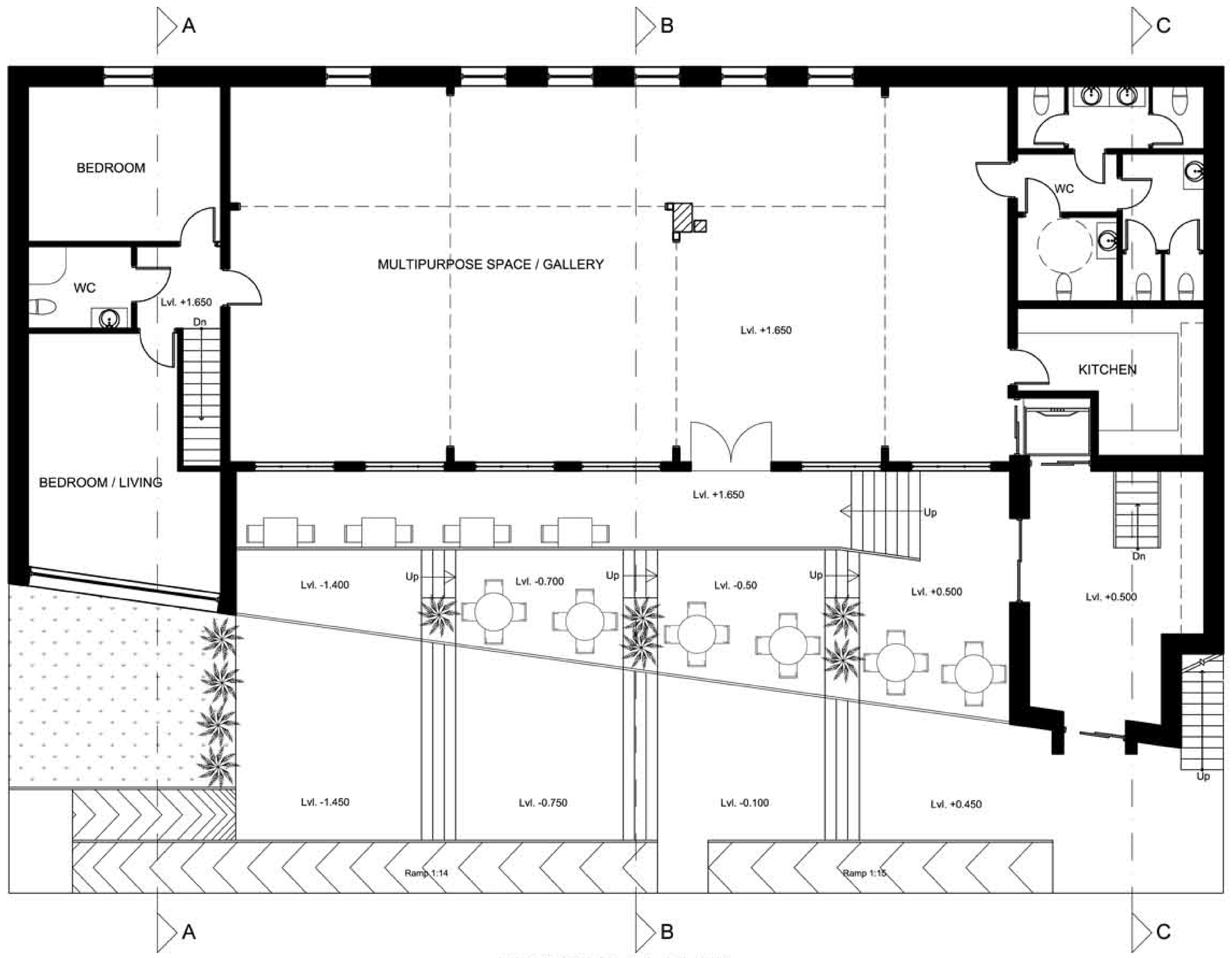
PLANS

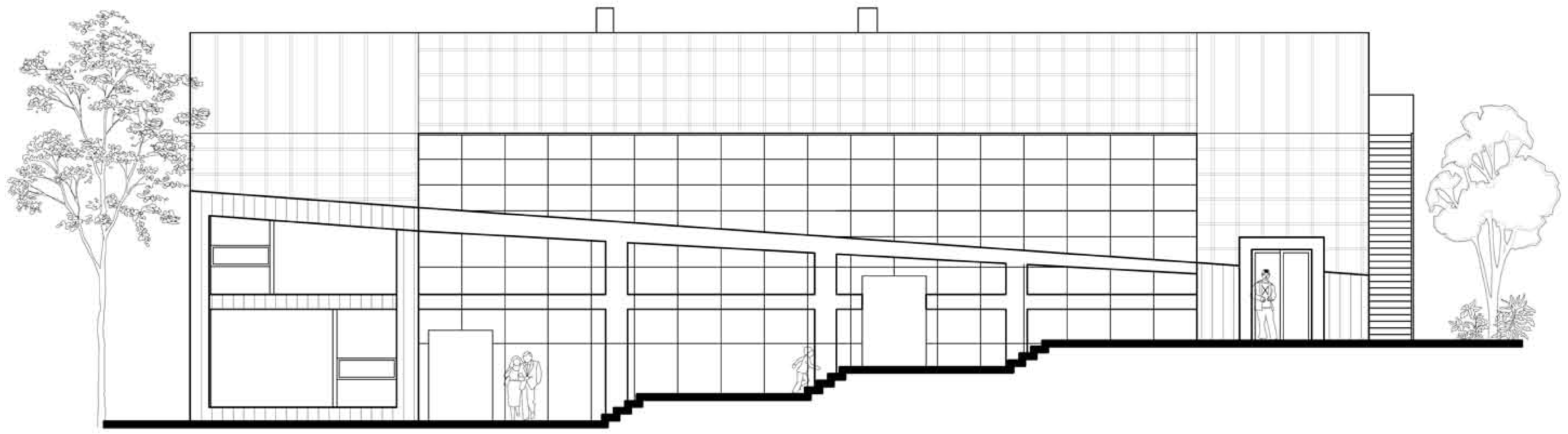


LOWER LEVEL PLAN
Scale 1:100

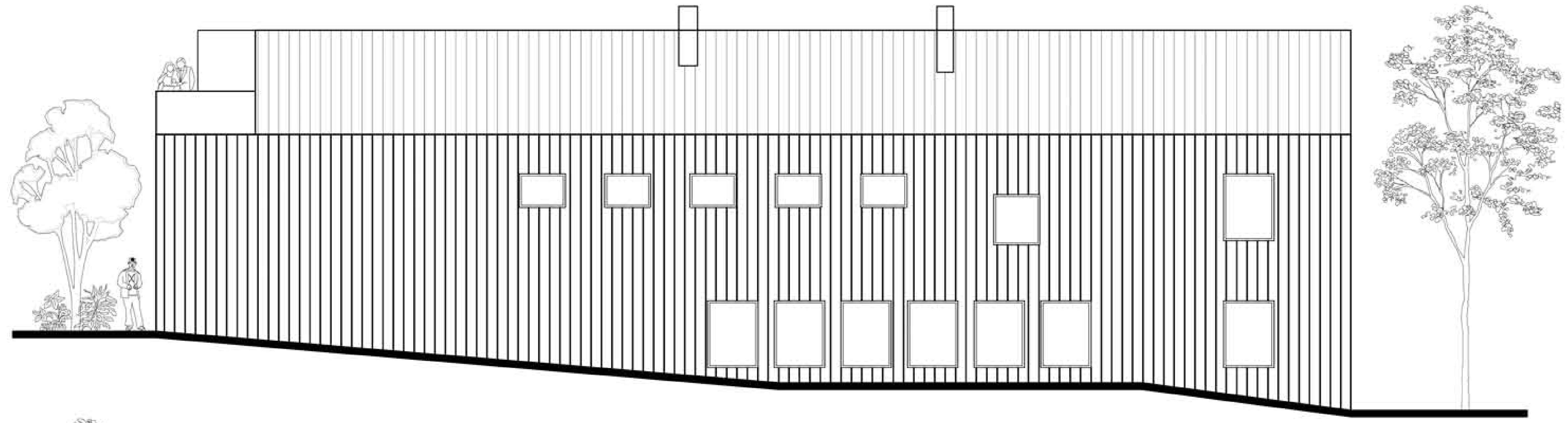


UPPER LEVEL PLAN
Scale 1:100

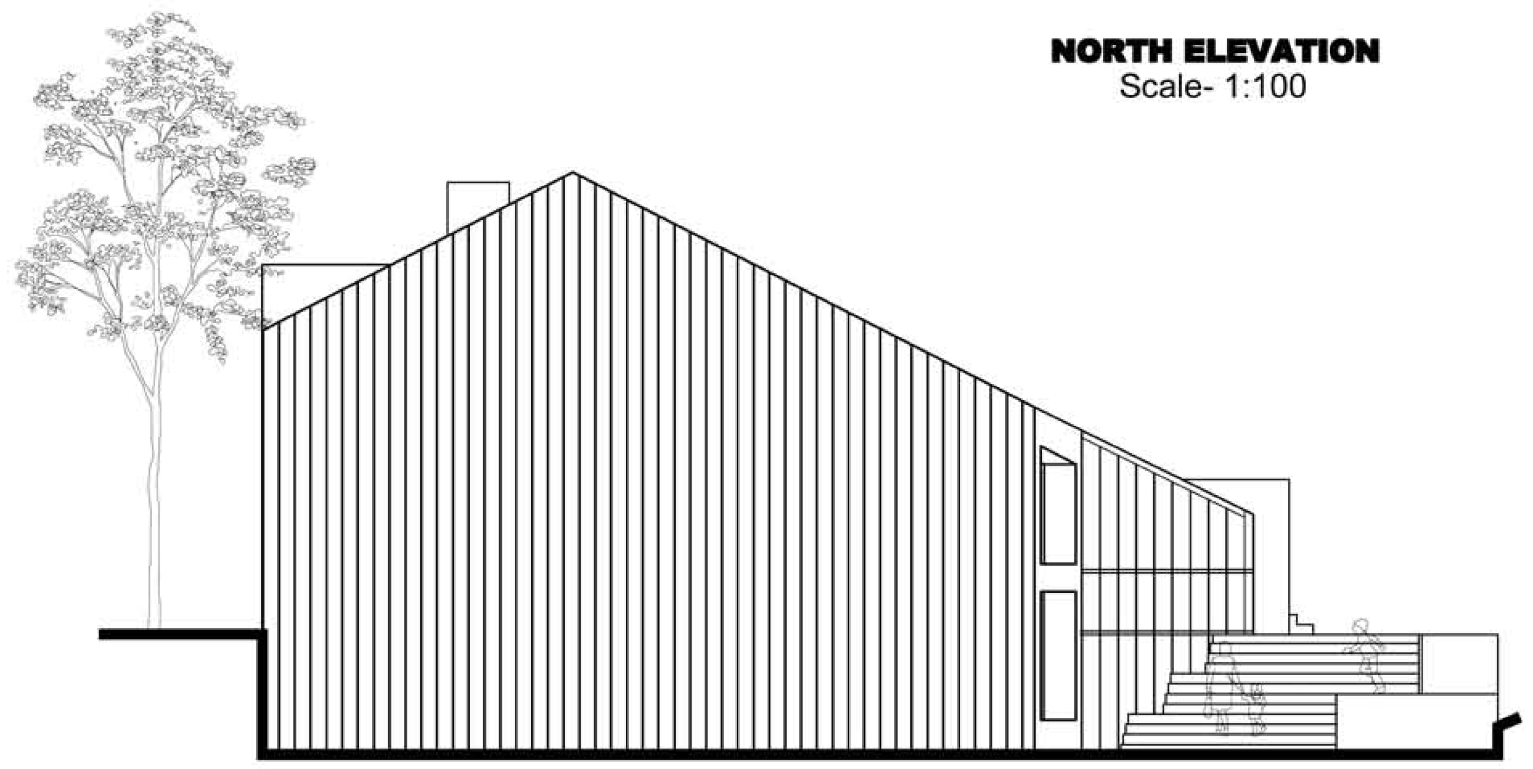
ELEVATIONS



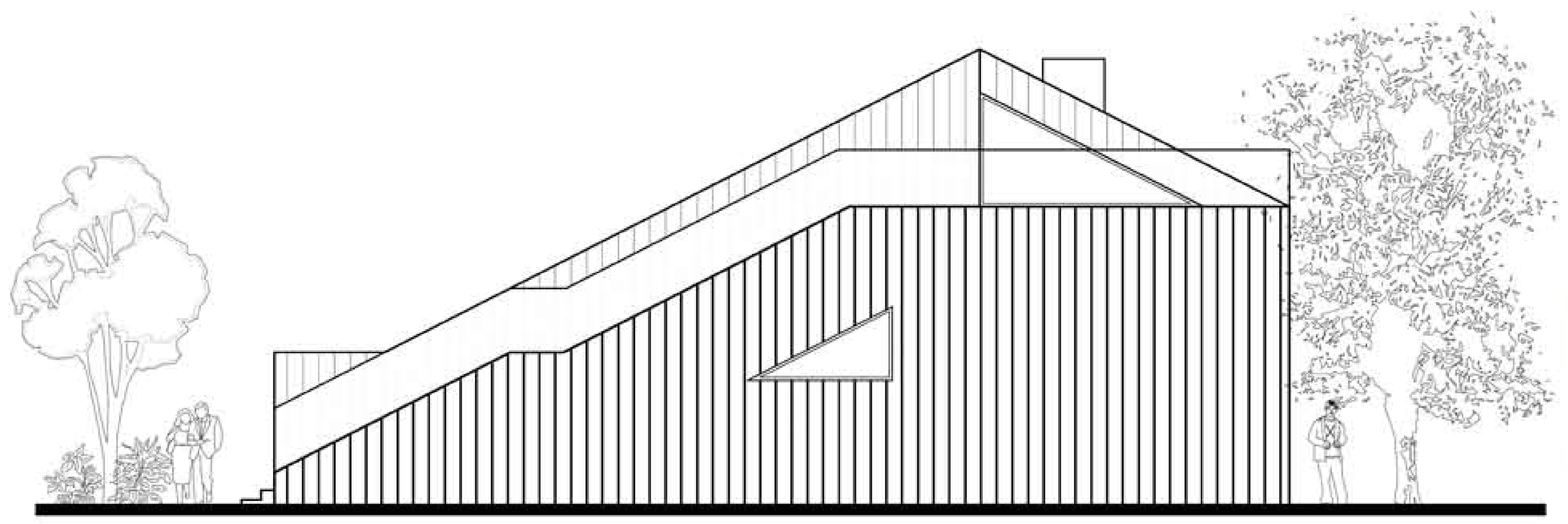
SOUTH ELEVATION
Scale- 1:100



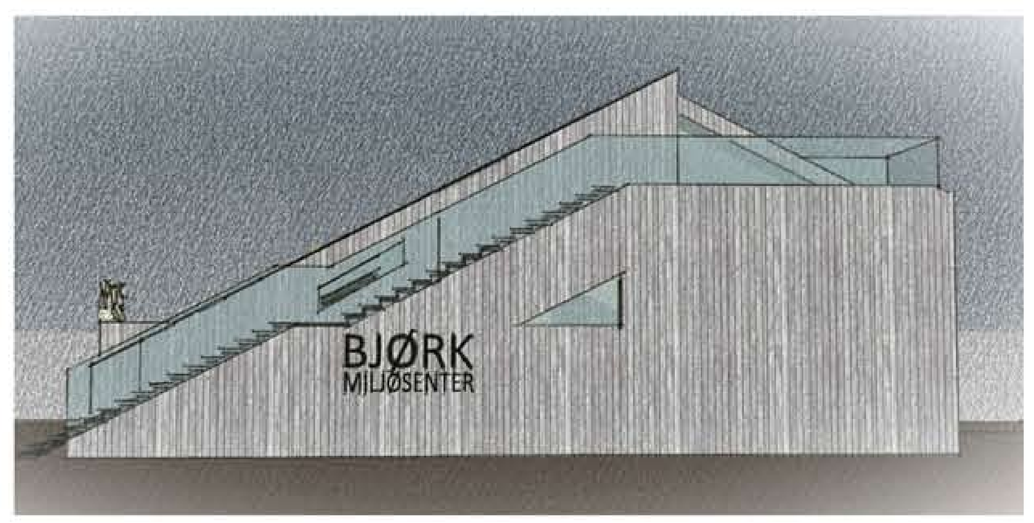
NORTH ELEVATION
Scale- 1:100



WEST ELEVATION
Scale- 1:100



EAST ELEVATION
Scale- 1:100



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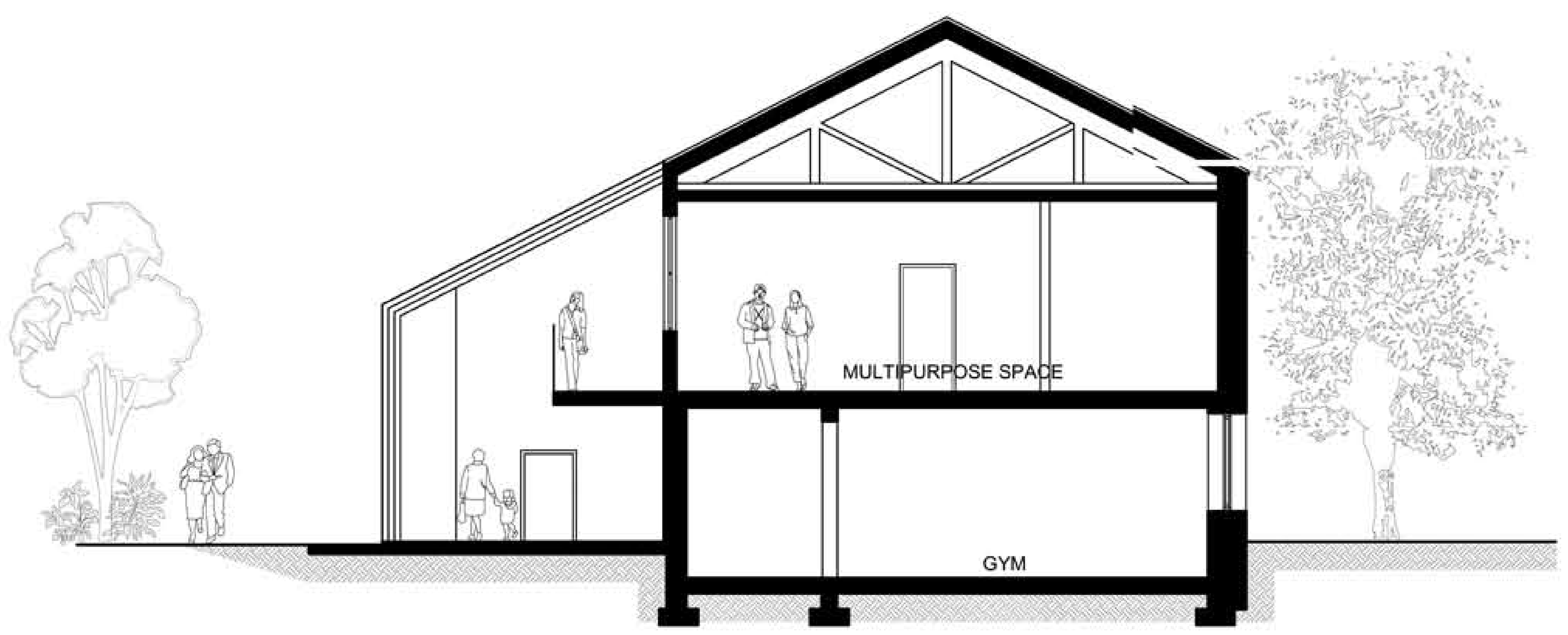
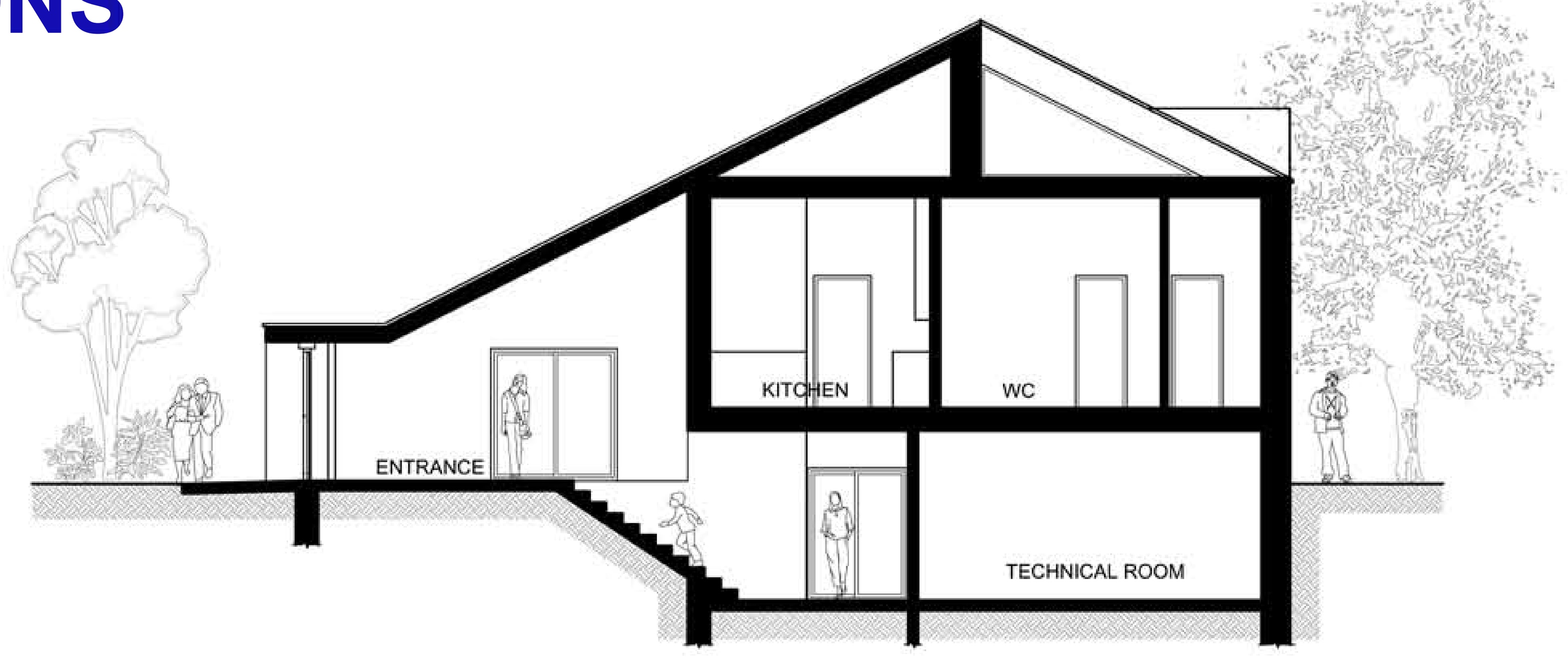
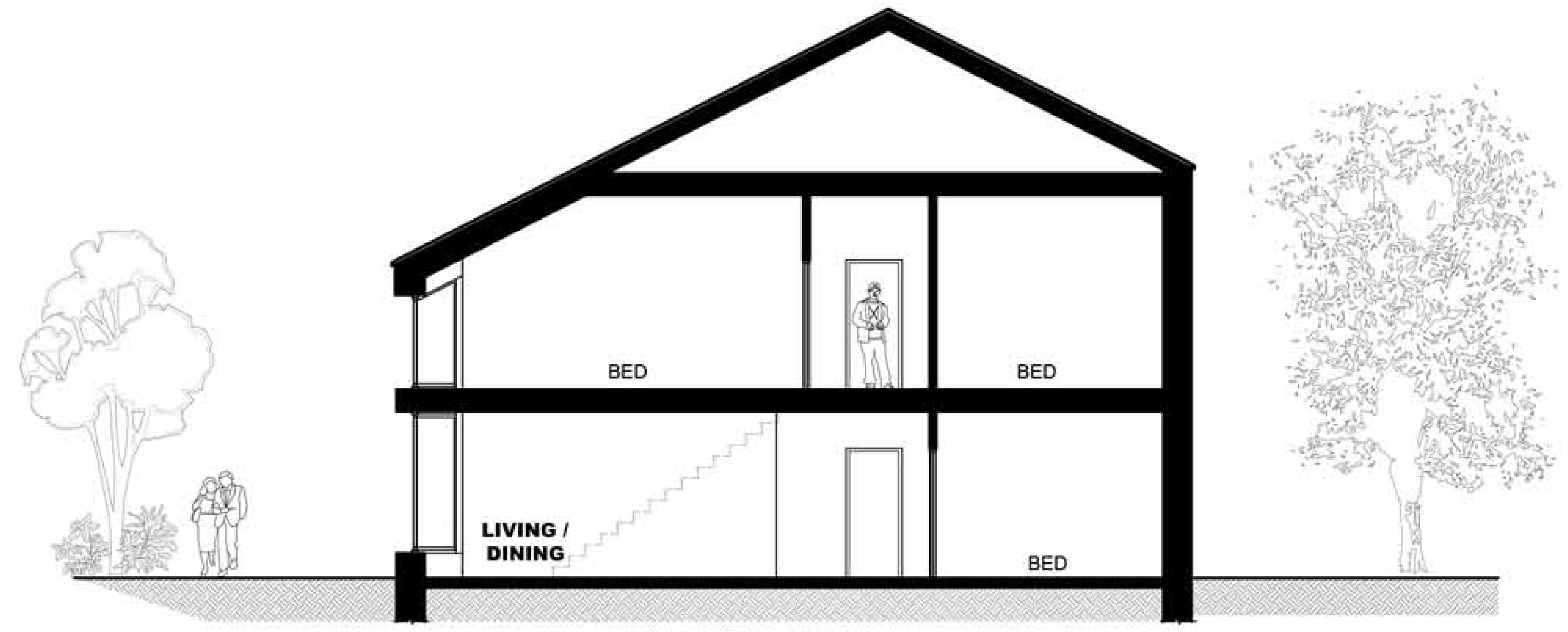
SECTIONS



SECTION B-B
Scale- 1:100

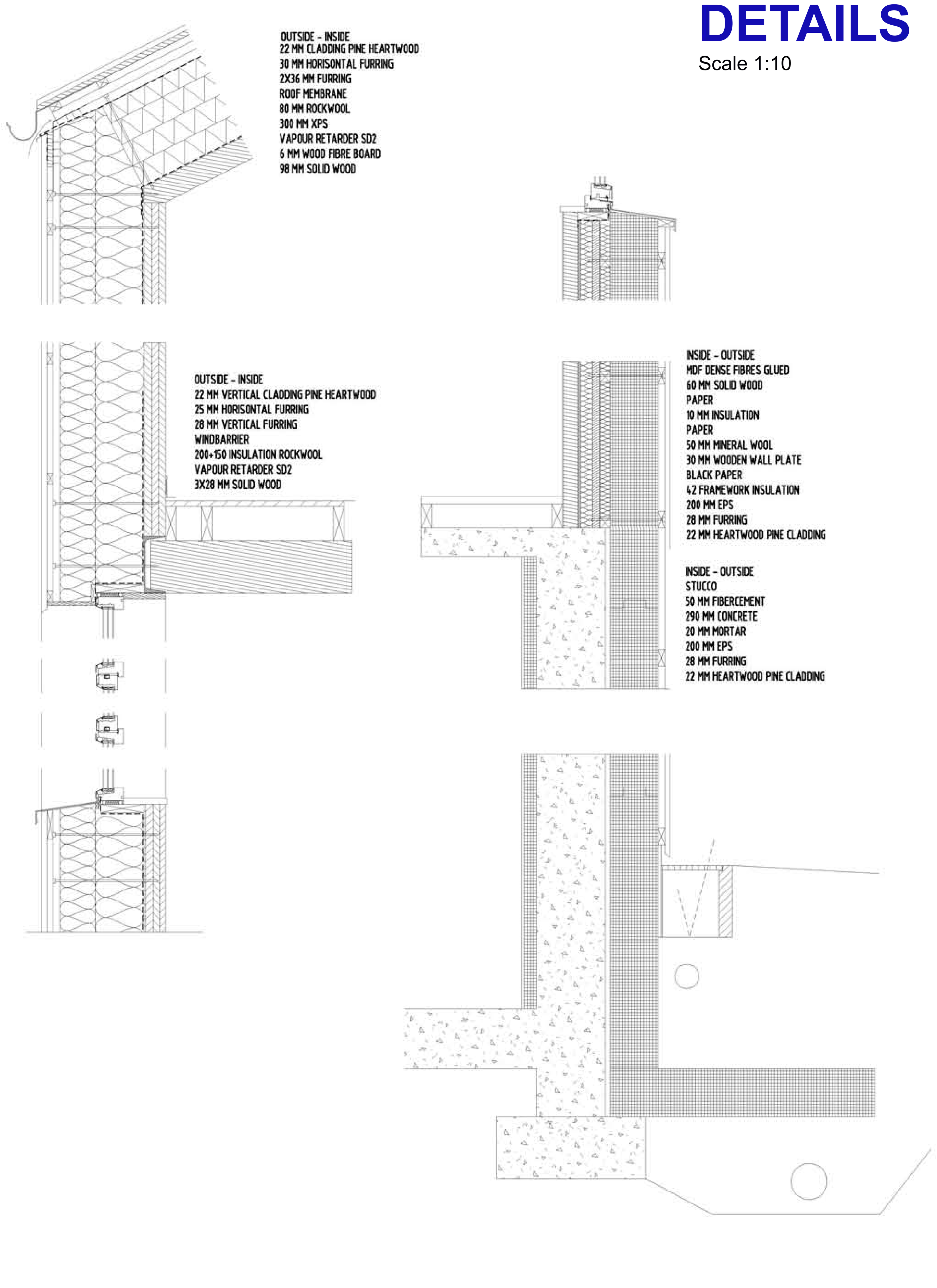


SECTION A-A
Scale- 1:100



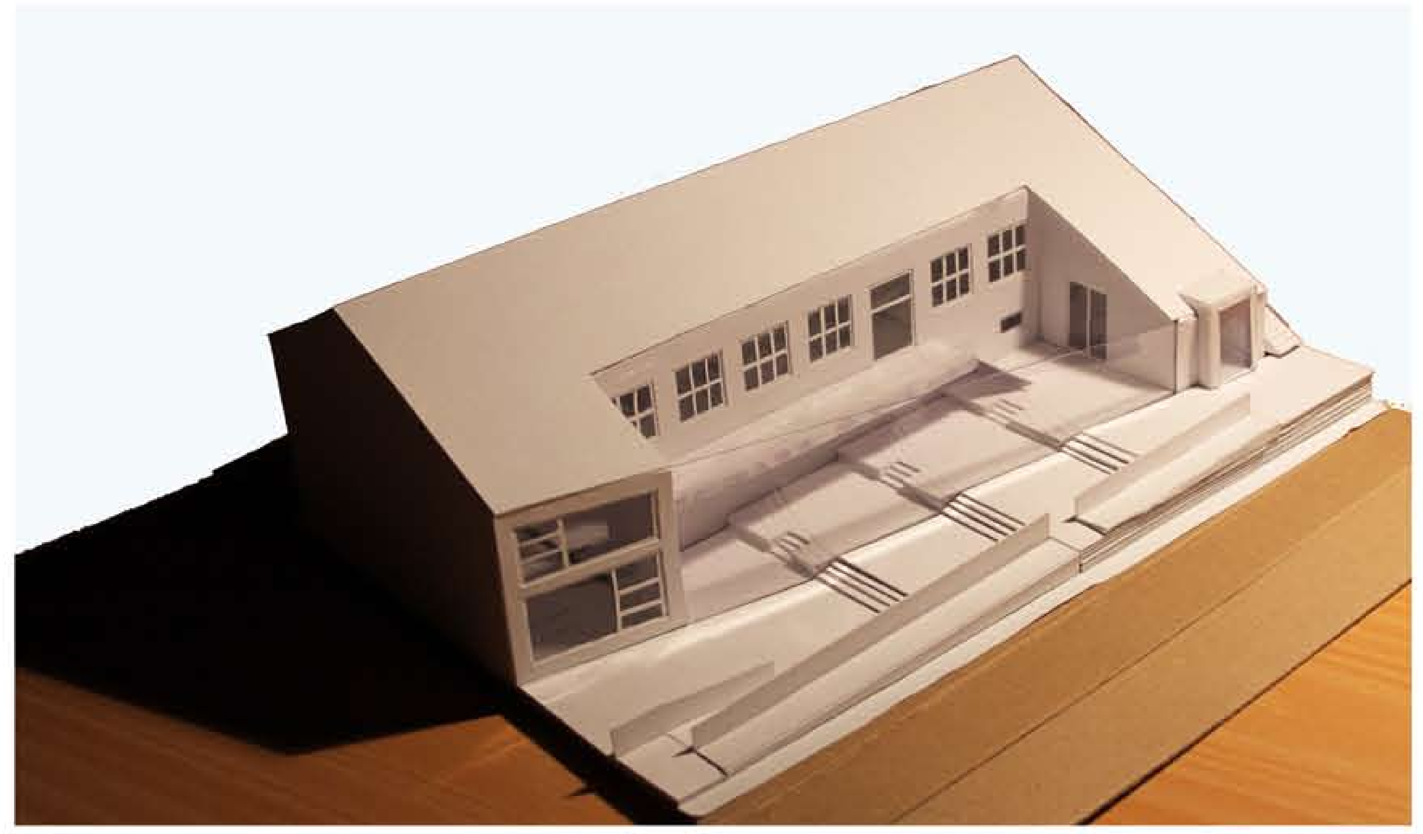
SECTION C-C
Scale- 1:100

DETAILS
Scale 1:10

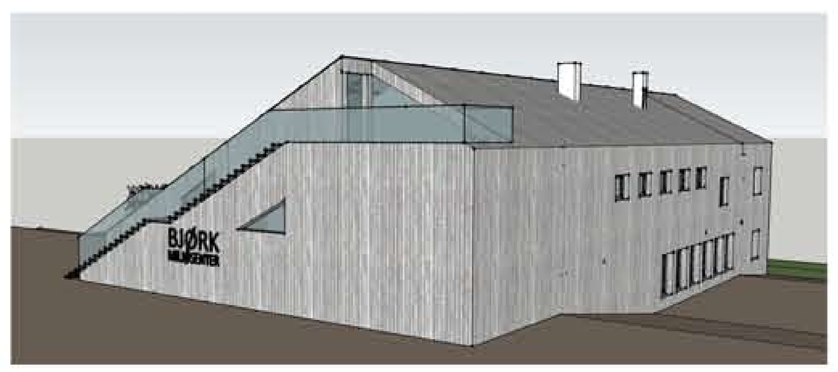


VIEWS

View from South-east



MODEL: View from south-west



Example for structure in the sunspace (Trondheim Torg)

Main View

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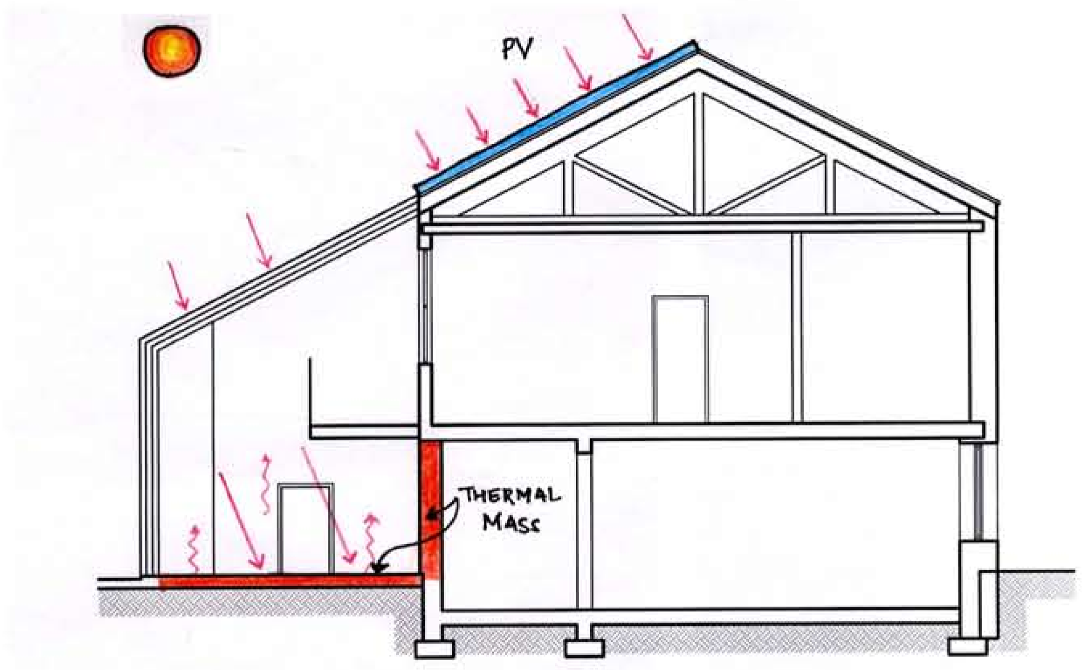
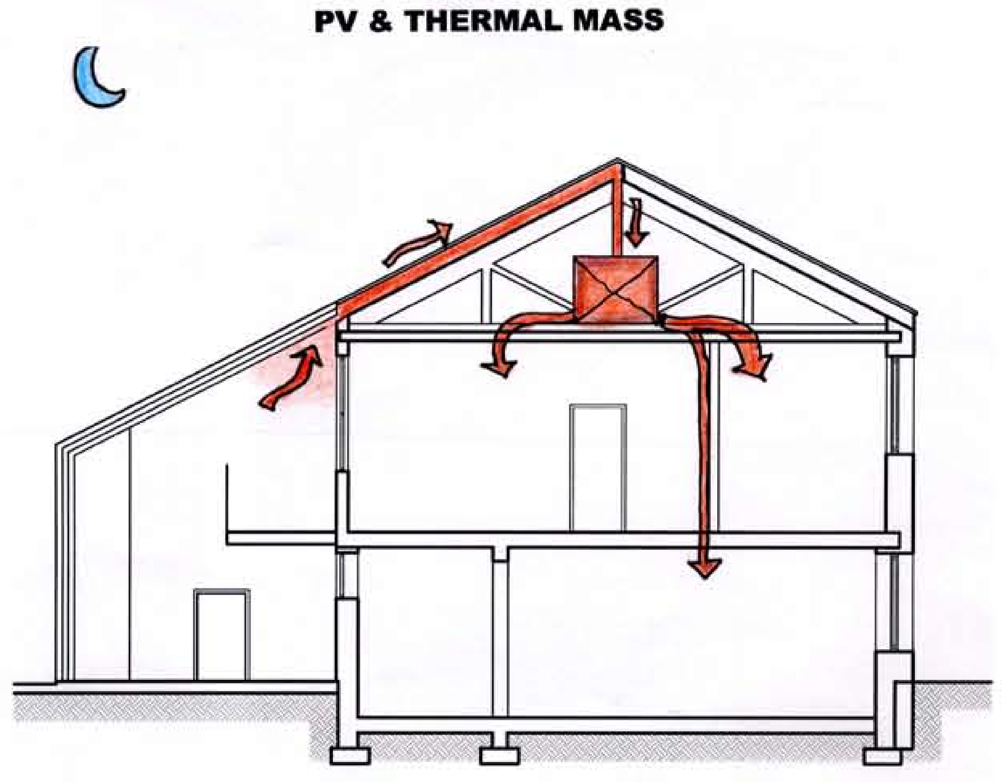
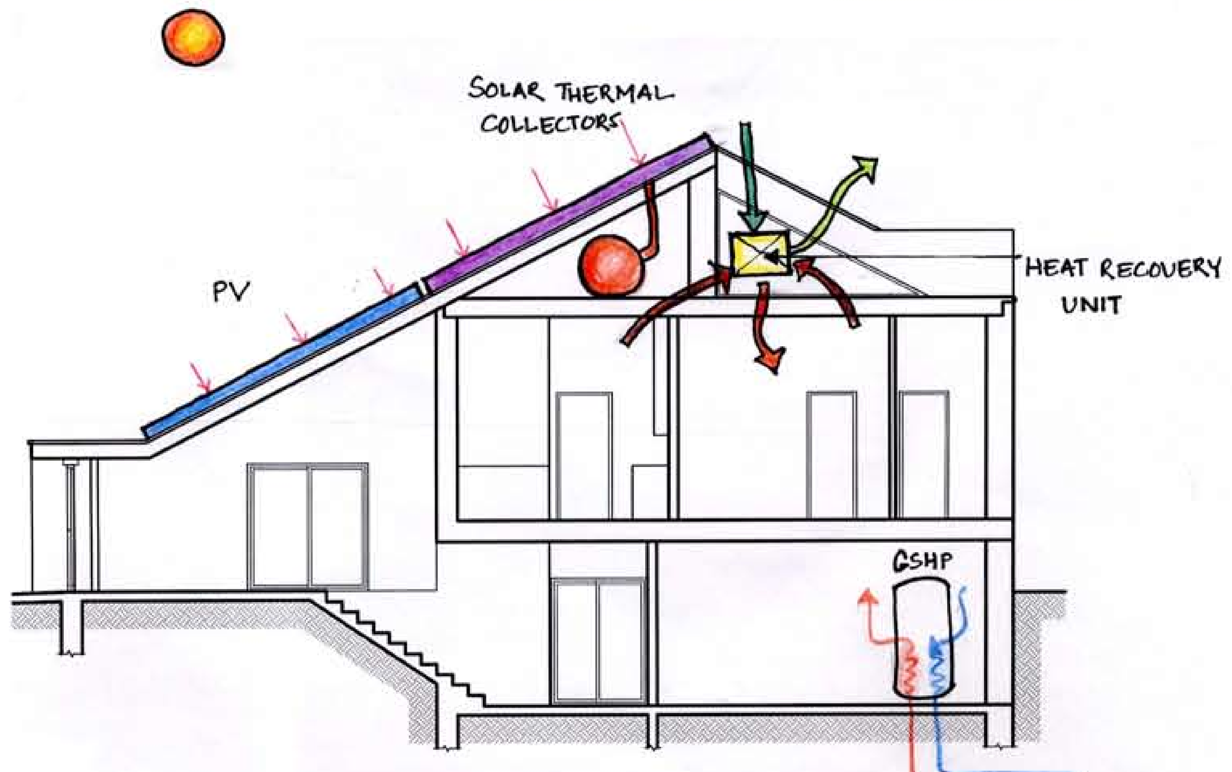
ENERGY STRATEGIES



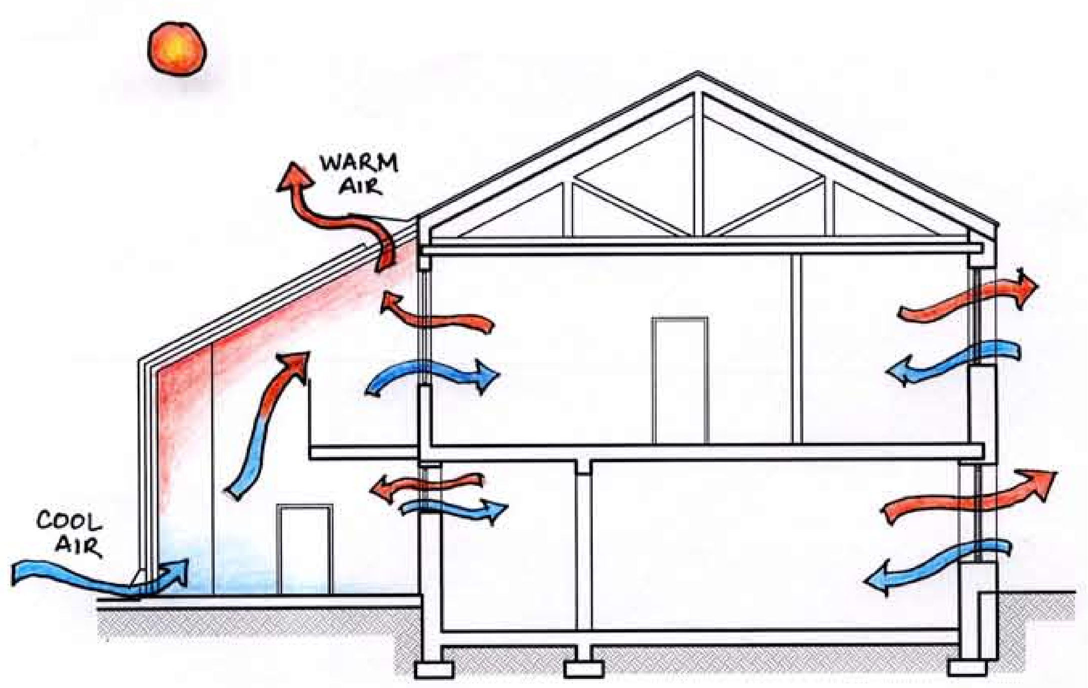
PV & THERMAL MASS



HEAT RECOVERY



PV / SOLAR THERMAL COLLECTORS



NATURAL VENTILATION

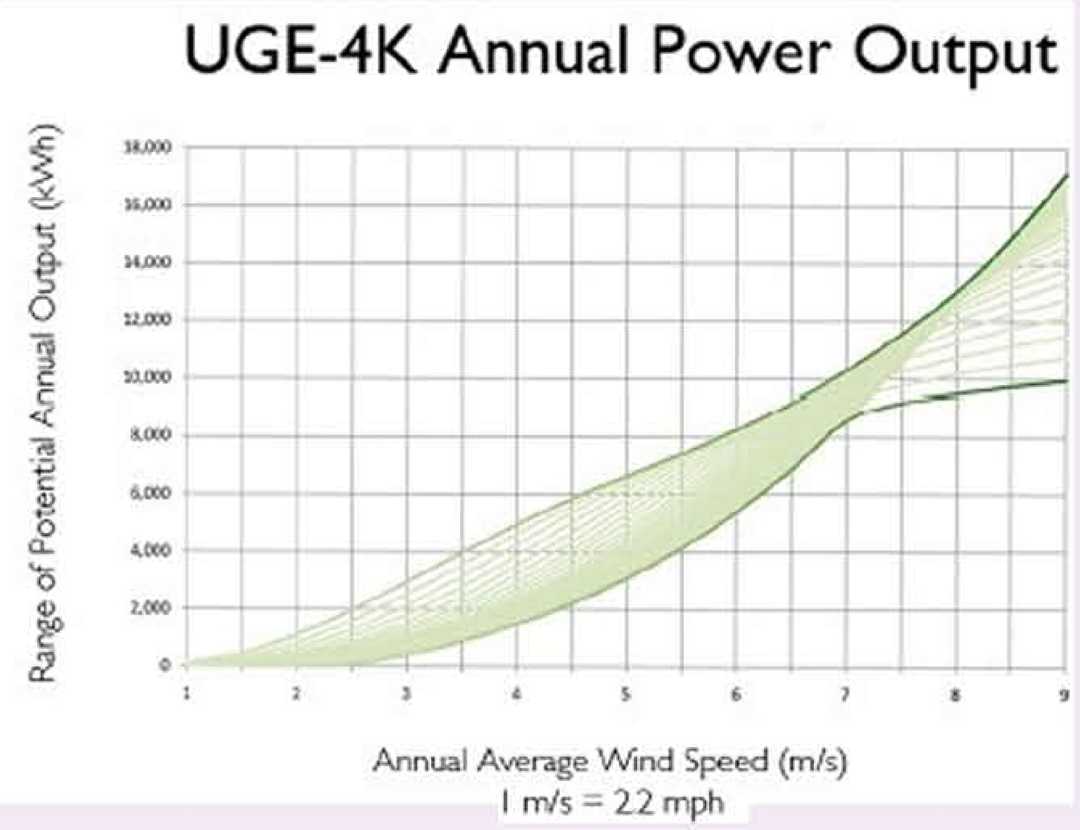
WIND TURBINE

General

Axis	Vertical
Height	4.60 m (15.10 ft)
Width	3.00 m (9.85 ft)
Weight	461 kg (1016 lb)
Swept Area	13.8 m² (149 ft²)
Blade Materials	Carbon Fiber and Fiberglass

Performance

Rated Power	4000 W
Cut-in Wind Speed	3.5 m/s (7.8 mph)
Cut-out Wind Speed	30 m/s (67 mph)
Rated RPM	110 RPM
Survival Wind Speed	55 m/s (123 mph)
Rated Wind Speed	12 m/s (27 mph)
Noise Level at 12 m/s	49 dB



Passive strategies
- Orientation of the sunspace
- Thermal mass
- Insulation
- Natural ventilation

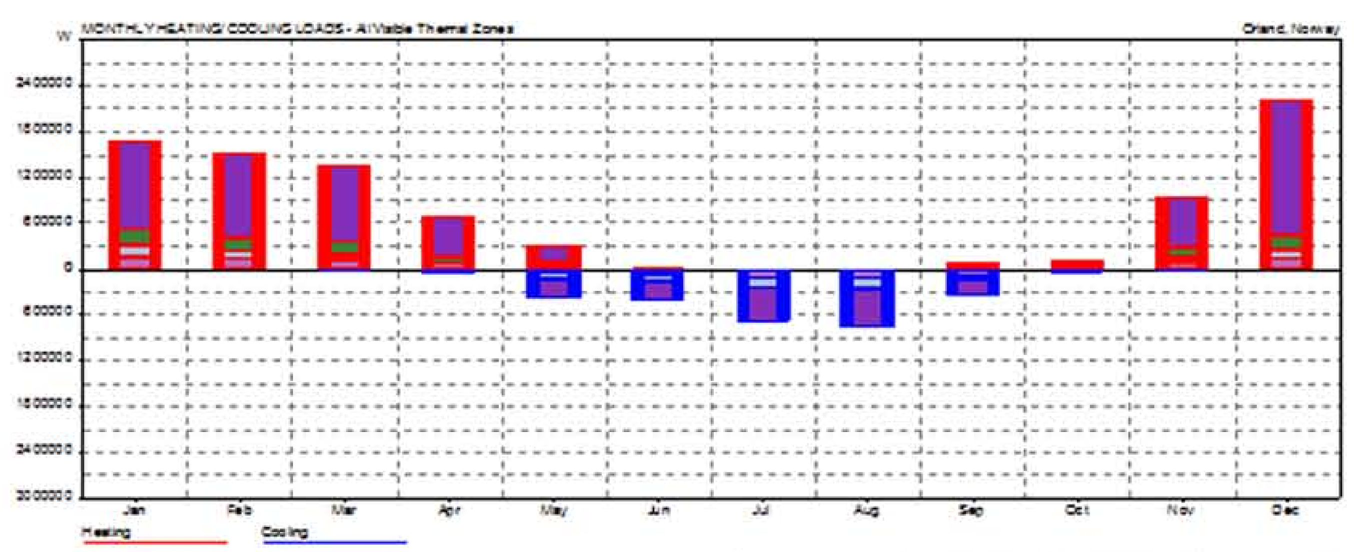
Active strategies:
- PV Crystalline PV (on the roof)
  Nominal power: 340W
  Area: almost 150m²
- Solar thermal collector (on the roof)
  Efficiency: 60%
  Area: approximately 26m²
- Heat pump
  Set temperature: 50 C
  COP: 2.8
- Wind turbine (in suitable location near site)
- Heat recovery system

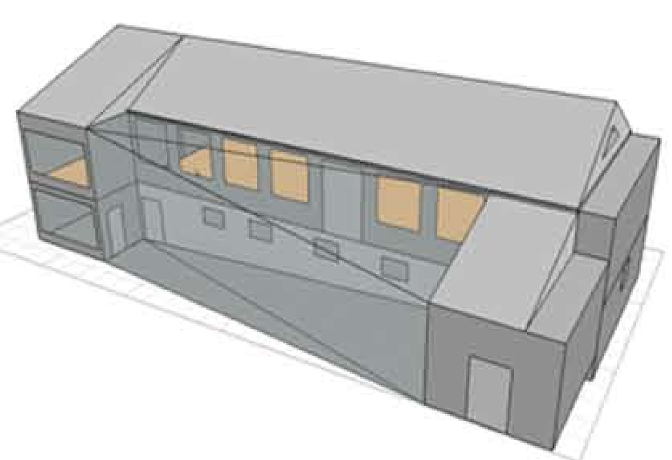
Energy budget:
For the energy calculation of this project, we divided this building into three different zones which are residential (106.6m), culture/office (198.2m²) and sport area (159.6m²). So the total heated floor area is 464.4 m².

Heating demand calcul ations:
Our main focus has been to document the design's potential to reach the passive house standard, which is less than 21.74 kWh/m² energy use in the building for space heating. For accuracy, we divided the model into four thermal zones and programmed different thermal temperatures and schedules for each zone. To estimate internal heat gains we also made a rough assumption of the amount of people using each zone. From the result, we can see that the building meets the space heating demand of passive house standard, which is 19.2 KWh/m².

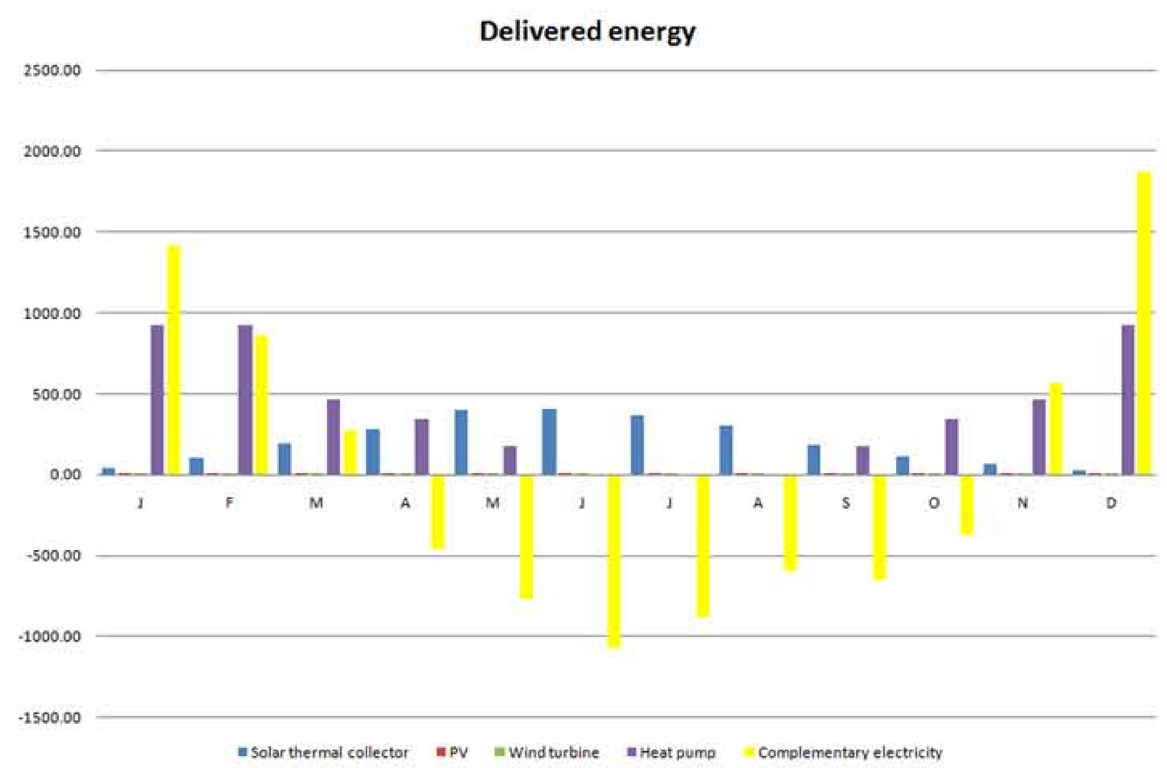
Heat balance
From the graph of the heat balance of the building, solar thermal collector and heat pump could provide enough heating demand for the house. In the summer, it produces much more heat which could be storage. But, in the winter, there should be some heat complemented by the electricity grid.
From the chart of electricity balance, the house needs some energy from electrical grid during the winter, and in the summer, the house will produce surplus electricity which could be sold to the grid.

CO_2 emissions
The chart shows that the CO_2 emissions of the building from the energy perspective. In summer, the building could produce much more green electricity which could be sold to the grid; thereby compensating CO_2 production during winters.





MONTH	HEATING (Wh)	COOLING (Wh)	TOTAL (Wh)
Jan	1667302	0	1667302
Feb	1505826	0	1505826
Mar	1358103	25953	1384056
Apr	684460	70939	755398
May	317166	375289	692455
Jun	13253	425503	438756
Jul	6498	695363	701862
Aug	5775	760896	766671
Sep	66788	348524	415312
Oct	117361	60807	178168
Nov	946406	24155	970561
Dec	2226450	3524	2229974
TOTAL	8915389	2790952	11706342
PER M	19197.6507	6009.80189	41.3386105
Floor Area:	464.4	m2	



ENERGY BUDGET

	heat		electricity		total
	Net energy demand [kwh/a]	Specific energy demand [kwh/(m²a)(464.4m²)]	Net energy demand [kwh/a]	Specific energy demand [kwh/(m²a)(464.4m²)]	
heating	10093.768	21.74			
domestic hot water(DHW)	12119.0918	26.10			
fans			4820.724	10.38	
pumps			1441.44	3.10	
lighting			6430.144	13.85	
technical equipment			4876.782	10.50	
cooling					
sum	22212.8598		17569.09		39781.95
		47.83		37.83	85.66