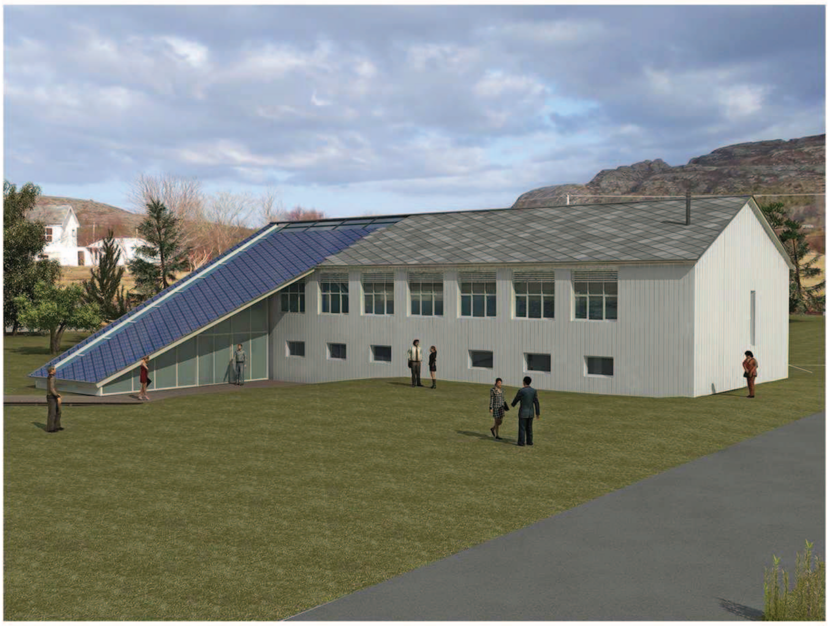
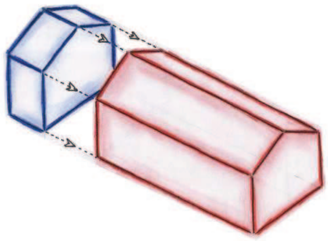


DESIGN CONCEPT

- Adding a buffer zone on the West side of the original building for energy preservation.
- Installing active solar systems on the roof of the extension for energy production.
- Demonstrating energy production by bringing down the roof slope of the extension to the level where the energy production will be visible and accesible to the visitors.
- Clear visual distinction between original energy receiving volume and new energy producing volume.

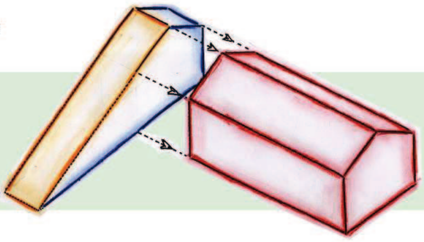


Preserving energy

Original building

West buffer zone

Active solar

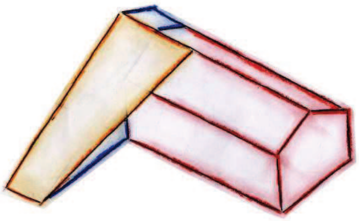


Producing energy

LINESØYA PASSIVE HOUSE PROJECT-DEMONSTRATION CENTER

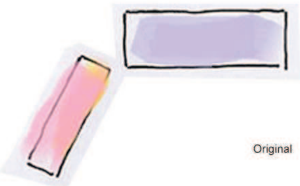
Group 6

Posters made by: Chenchen Guo, Nigar Zeynalova

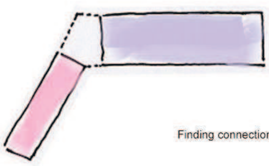


Demonstrating energy production

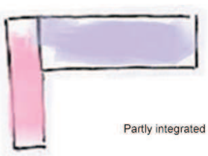
DESIGN PROCESS



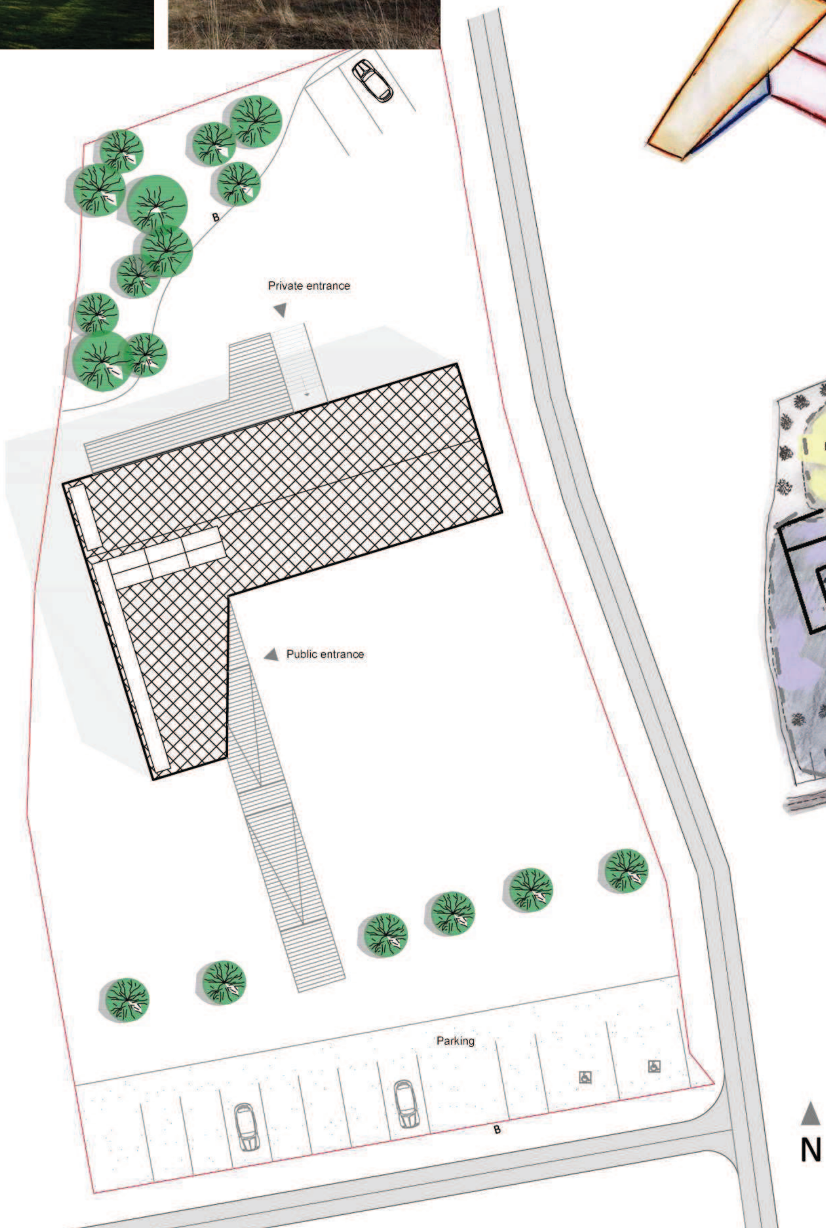
Original

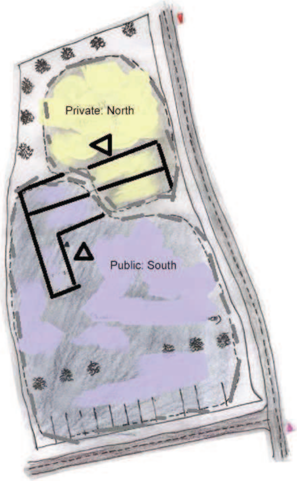


Finding connection



Partly integrated



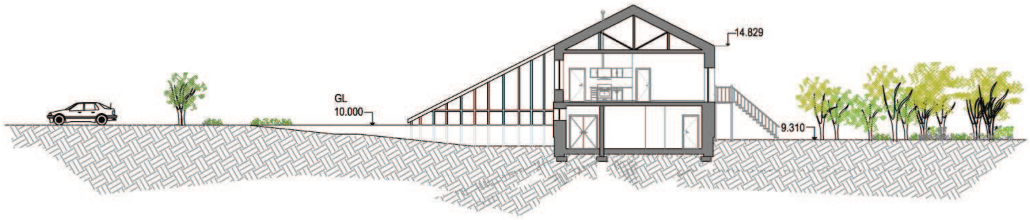


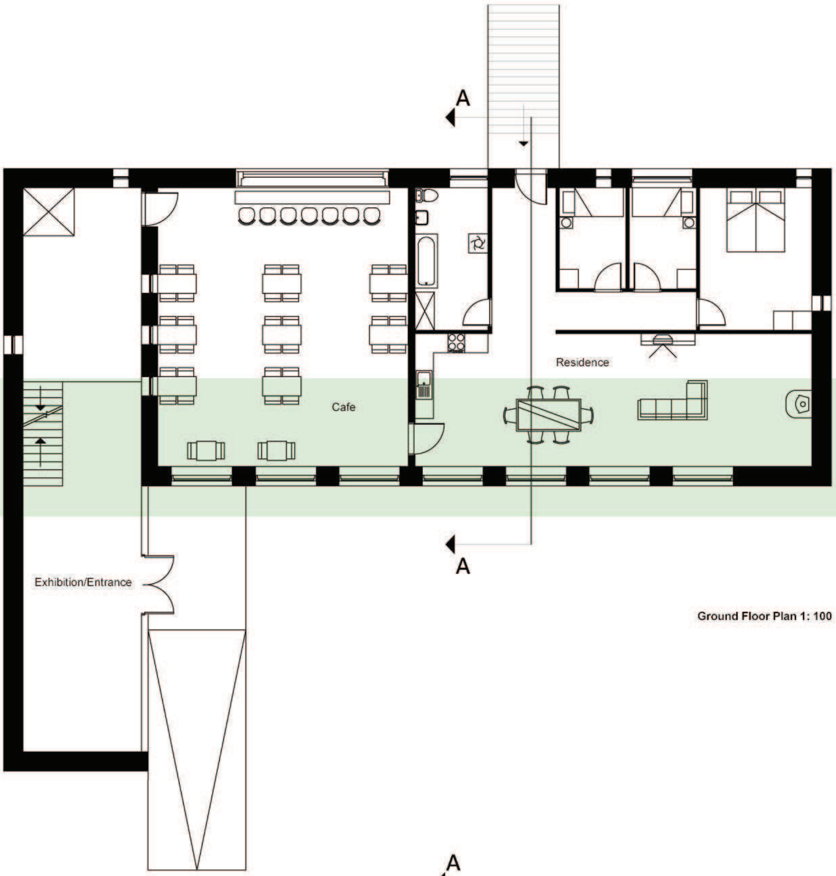
Private/Public Division

Site Plan 1: 200

REFERENCE
http://www.linesoygalleri.no/en/gallery_en.html

Site Section B-B 1: 200

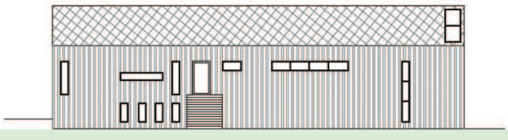




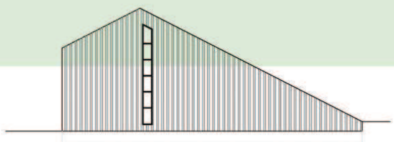
Ground Floor Plan 1: 100

Elevation 1: 200

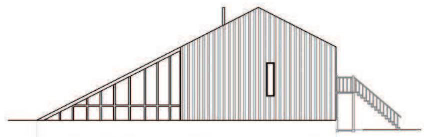
South



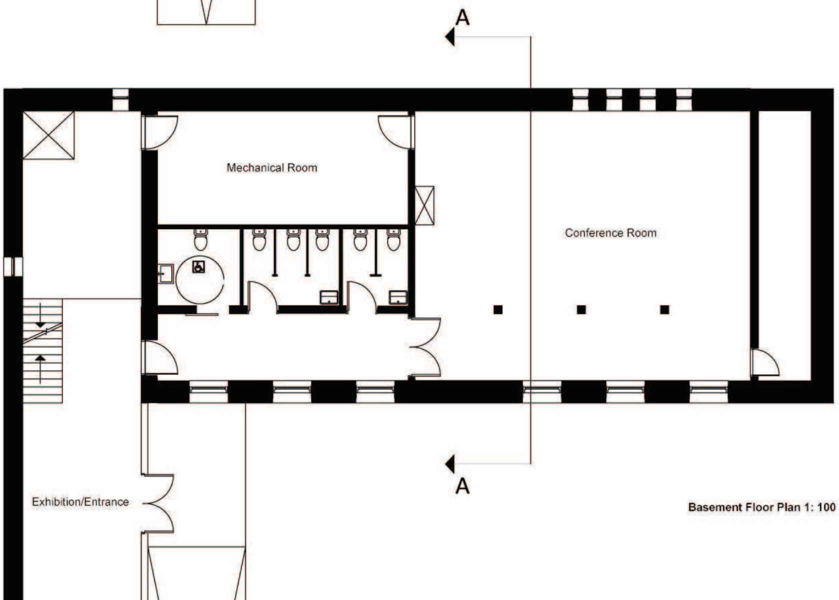
North

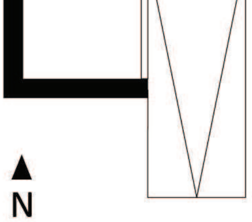


West



East

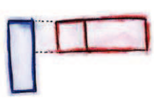


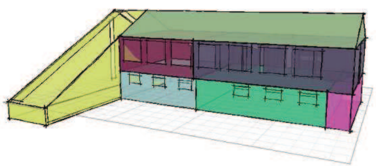


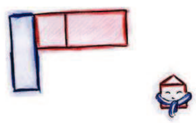
Basement Floor Plan 1: 100

N

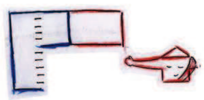
ZONING STRATEGY



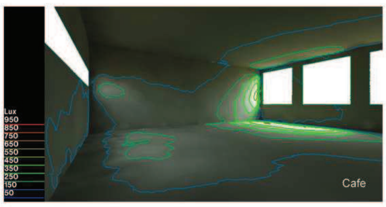


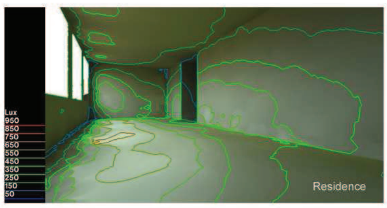


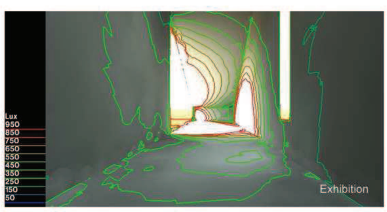
Winter: The original building is heated and protected by non heated exhibition/entrance zone

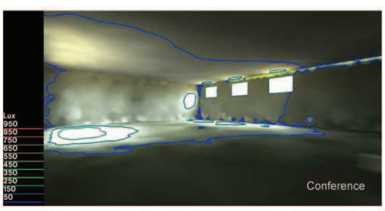


Summer: The cafe which has a slight cooling demand opens up to the exhibition/ entrance zone, which in turn opens up to the outside creating semiopen exhibition area.









Daylight analysis

As can be seen from the Radiance simulation living space in the residential zone has the average illumination level of 300 lux.The daylight levels satisfy the requirement for the kitchen, living room and reading area.

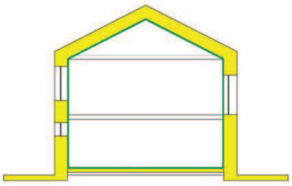
The daylight level in the café is 100-150 lux according to the requirement of 100 lux for restaurants.

The average daylight level in the extension are in accordance with the requirement for exhibition area – 500 lux.

The daylight levels in the conference area are 50-100 lux, due to the purpose of the room direct and abundant sunlight should be avoided.

Reference:Osbourn, D. and Greeno, R., Mitchell's Introduction to Building, 2002

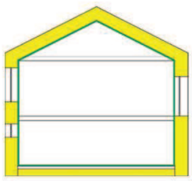
MAIN CONCEPT
• Insulating the entire building envelope
• Airtight from inner side of the insulation layer, airtight layers around the entire building envelope
• Thermal bridges should be prevented by adding insulation between the joints and airtight layer should also go through the back side of the opening frame



METHOD 1
The "hat method" suggested by ISOVER can be used in this case. By using hat method, insulation can be added around the building envelope and its surrounding ground.
Advantages:

• So this method provides easier refurbishment by only concentrating on the building external work
• Living area will not be reduced
• The insulation located in the surrounding ground can help reduce the heat losses from the basement floor since the temperature difference has been reduced
Disadvantages:

• There maybe be problems if the rain water cannot be drained away and remaining on top of the insulation layer
• The width of the surrounding ground insulation depends on the local condition (the depth of frost layer), sometimes up to 6 meter
Whether it is worth to dig the whole site 6 meter around the building to add insulation or it is better just to demolish the old basement floor and add insulation from outside



METHOD 2
Adding insulation around the building envelope in order to achieve passive house standard. Demolishing old basement floor, adding insulation from outside (against the soil). Using LECA nuts insulate the foundation.
Advantage:
• Since we cannot see the condition of the foundation, if in old days, the foundation work had not been done in the form work, then it is hard to use the hard insulation to insulate the irregular shape of the foundation, LECA nuts can be used as insulation on both side of the foundation
• New insulation adding from outside, prevent moisture problems

Disadvantage:
• The foundation will not be totally insulated
• LECA nuts insulation performance will not be as good as real insulation materials

WHAT WE HAVE KEPT
Roof:
• Slates
• Trussed-rafters
Groud floor external wall:
• Massive wood panels (structure)
• Wooden cladding
Floor Partition:
• Concrete slab
• wooden floor joists
Basement floor:
• Basement concrete floor
Basement wall:
• Concrete wall (290mm)

WHAT WE HAVE CHANGED/ADDED
Roof:
• Insulation
Ground floor external wall:
• Insulation
• Wooden studs wall towards inside
Floor Partition:
• Sound insulation
• new wooden floor
Basement floor:
• Additional insulation
Basement wall:
Insulation from both inside and outside

CONSTURCTION MATERIALS AND METHOD CAN BE FOUND FROM THE SUPPLIERS

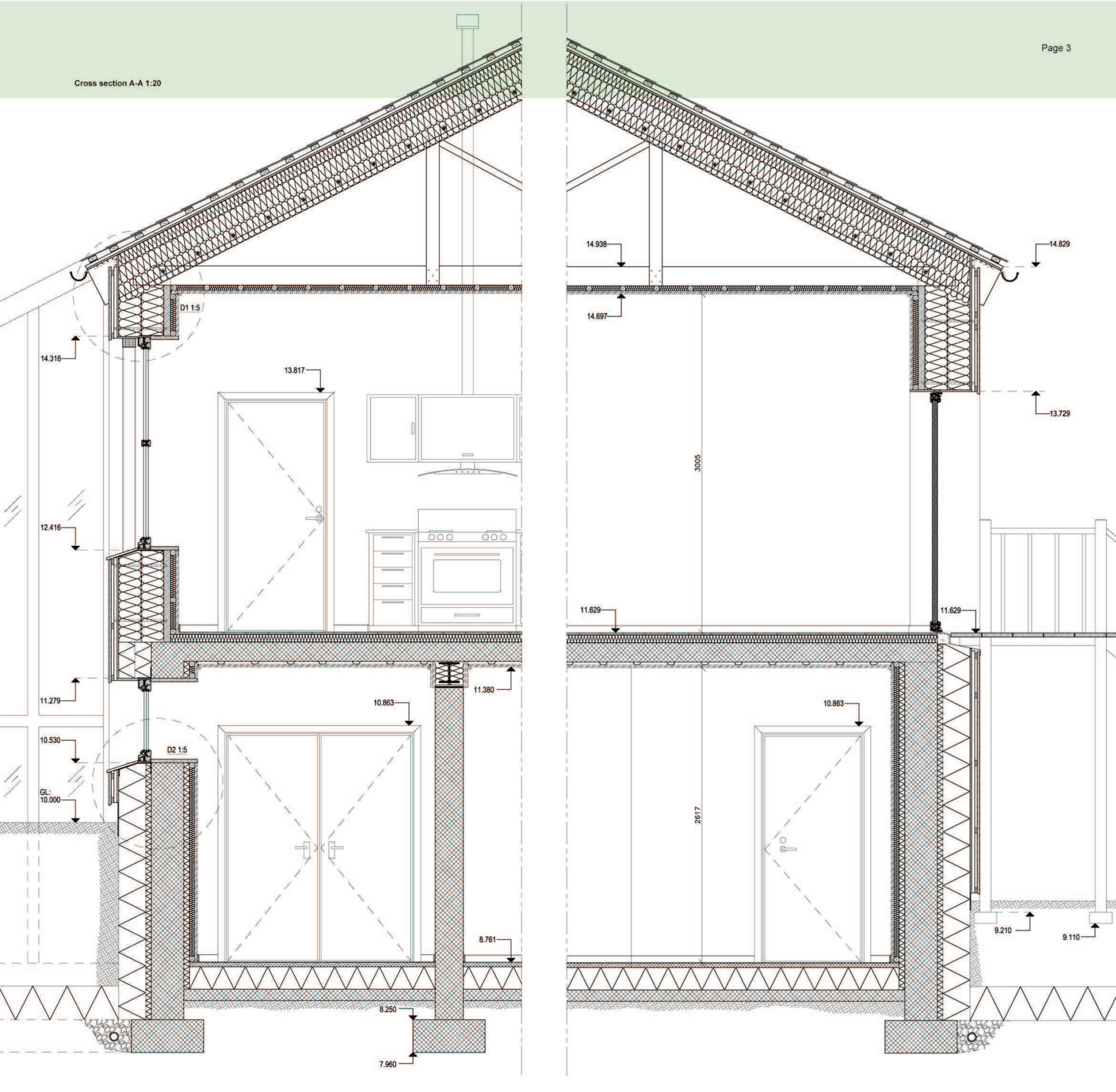
Feasible suppliers for Insulation materials
• Rockwool (www.rockwool.dk, Rockwool facadesystem til renovering)
• EPS/ XPS, drainage insulation (www.jackon.dk, Jackopor og Jackofoam dræplade)
• LECA nuts (www.weber.dk)

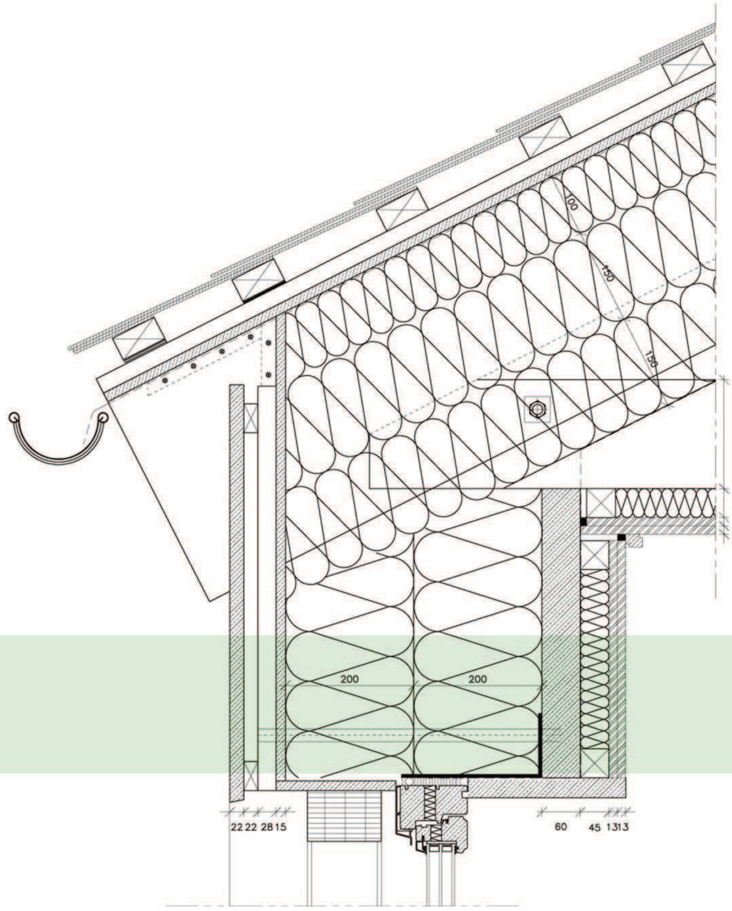
Feasible suppliers for openings
• NorDan triple glazing window (www.nordan.co.uk)
• NorDan exterior door (www.nordan.co.uk)

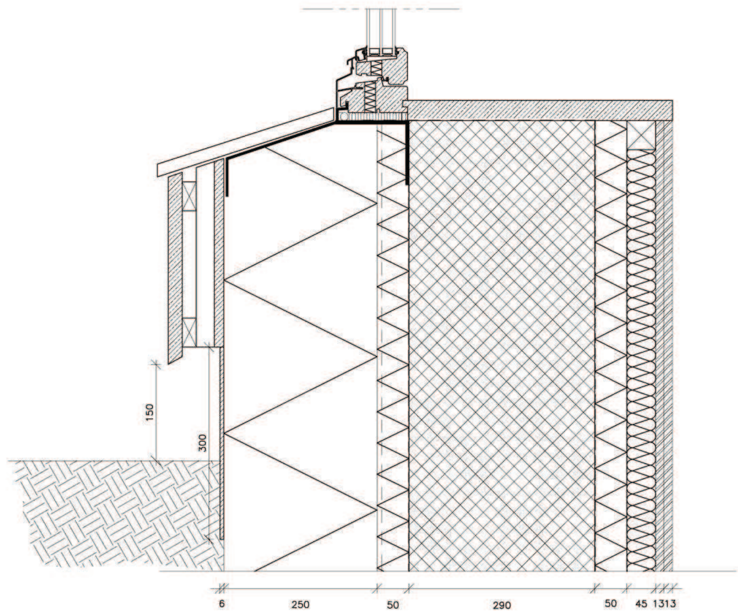
Feasible suppliers for covering visible basement insulation
• Cembrit fiber board made by natural materials (www.cembrit.dk , Cembrit PLANP Plader, NCS kode: S 1002-Y)

Roof slates
Cutted timber
Rockwool insulation/mineral wool insulation
Hard insulation
Wooden boards
Gypsum board
Soil
LECA nuts
Concrete

Cross section A-A 1:20







METHOD 1

BASEMENT EXTERNAL WALL

Method description:

Insulation will be added from outside. As the rule of thumb, the interior insulation thickness should be max 1/3 of the exterior ones. 300mm EPS has been added from outside, and 95mm insulation has been added from inside.

Disadvantage :

1. We need solution for drainage system in the insulation layer (has been solved)

Construction description (from inside to outside):

1. 2x12.5mm gypsum boards (ventilated from bottom 300mm away from the floor, 300mm away from the ceiling)
2. 45mm insulation between vertical wooden studs (c/c 600mm)
3. 50mm EPS/XPS
4. Vapour barrier
5. 290mm concrete wall (original)
6. Water proof membrane (e.g. bitumen felt)
7. 50mm EPS drainage board (e.g. supplier: JACKON basement solution)
8. Fiber layer (preventing soil blocking the drainage gap on drainage board)
9. 250mm EPS

ROOF

Method description:

In order to fulfill the passive house standard, we have to add more insulation on the roof. Since we want to keep the original trusses, we have to extend the trusses in order to create space to add more insulation. 350mm new truss mechanicaly fixed on the old trusses.

Construction description (from inside to outside):

1. Vapour barrier
2. 2x150mm+100mm=400mm insulation
3. Roof underlayer
4. 25x45mm distance strip
5. 38x72mm battens
5. 600x600mm slates (from original building)

GROUND FLOOR EXTERNAL WALL

Method description:

In the original construction, the 60mm massive wood is the load bearing construction. Insulation will be mainly added from outside the massive wood. The window will be located in the insulation layer in order to prevent the thermal bridges. Steel brackets will be fixed on top and bottom of the window in order to fill in the elastic sealant.

Construction description (from inside to outside):

1. 2x12.5mm gypsum board
2. 45mm insulation fills in between the battens (c/c 600mm)
3. Vapour barrier
4. 60mm massive wood
5. 2x200mm insulation
6. 15mm OSB
7. 28mm vertical wooden studs for ventilation purpose
8. 22mm horizontal wooden studs
9. 22mm vertical wooden claddin

BASEMENT EXTERNAL WALL (ON TOP OF THE SOIL)

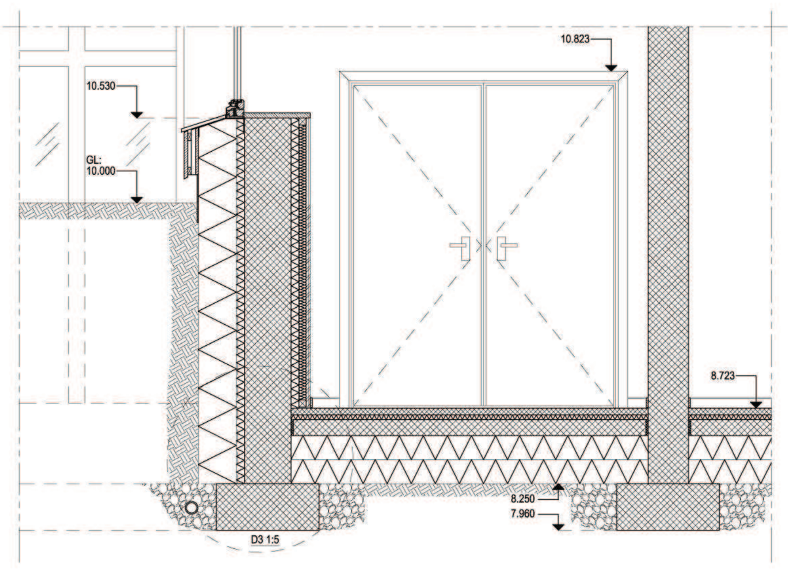
Method description:

Considering the architectural design, we would like to bring the cladding down to cover the basement wall which was originally exposed to outside. But cladding cannot be brought down until touching the terrain due to water and mud damage. So we will use white color fiber board to fix on the insulation on the basement exterior wall to give a nice look for the facade. The fiber board will be 300mm in height and 6mm in thickness.

Construction description (from inside to outside):

1. 2x12.5mm gypsum boards (ventilated from bottom 300mm away from the floor, 300mm away from the ceiling)
2. 45mm insulation between vertical wooden studs (c/c 600mm)
3. 50mm EPS/XPS
4. Vapour barrier
5. 290mm concrete wall (original)
6. Water proof membrane (e.g. bitumen felt)
7. 50mm EPS drainage board (e.g. supplier: JACKON basement solution)
8. Fiber layer (preventing soil blocking the drainage gap on drainage board)
9. 250mm EPS
(10. 6mm fiber cement board)
11. 15mm OSB
12. 28mm vertical wooden studs for ventilation purpose
13. 22mm horizontal wooden studs
14. 22mm vertical wooden cladding (150mm away from the ground)

Cross section for method 2 1:20



METHOD 2

BASEMENT FLOOR

Method description:

If the floor has been insulated from inside, it might cause moisture problem in the basement room. So it could be a good solution to demolish the original basement floor and adding insulation from inside.

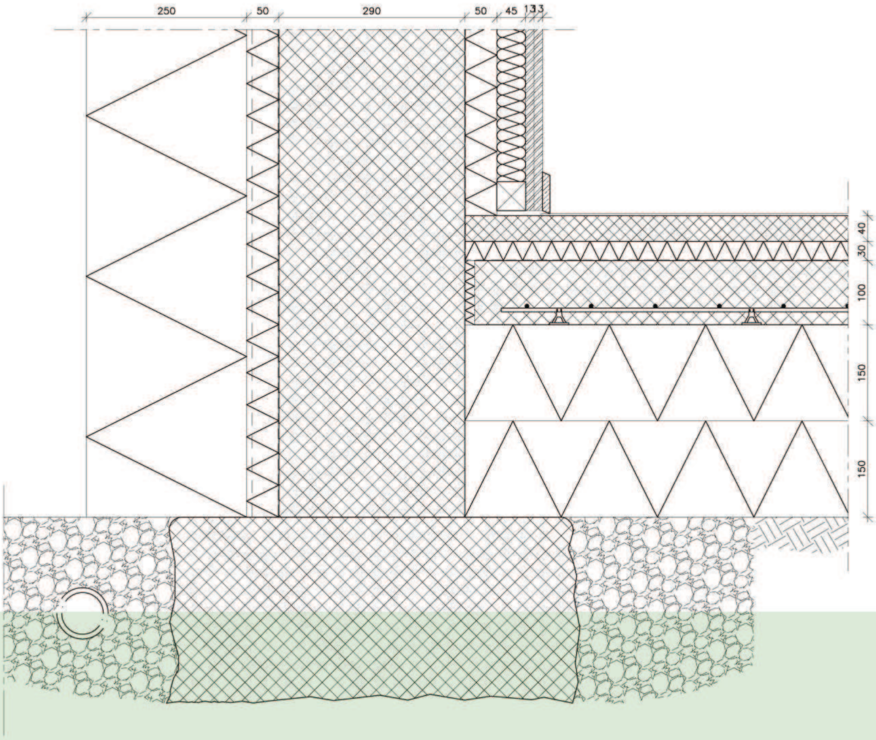
Disadvantage:

1. Demolishing work for original concrete floor
2. Whether we need certain solution to prevent the movement of basement exterior wall caused by the soil pressure from outside (has been solved)

Construction description:

1. 2x150mm EPS
2. 100mm reinforced concrete floor
3. Vapour barrier
4. 30mm EPS/XPS
5. 40mm screed
6. 3mm linoleum floor

D3 1:5



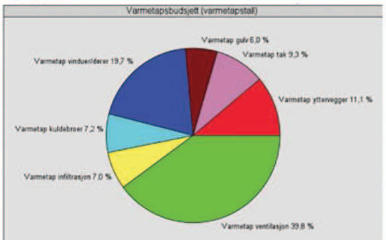
ENERGY CALCULATIONS
Made by: **Kristof Lijnen**

Dokumentasjon av sentrale inndata (1)		
Beskrivelse	Verdi	Dokumentasjon
Areal yttervegger [m²]:	353	
Areal tak [m²]:	335	
Areal gulv [m²]:	258	
Areal vinduer og ytterdører [m²]:	87	
Oppvarmet bruksareal (BRA) [m²]:	622	
Oppvarmet luftvolum [m³]:	1596	
U-verdi yttervegger [W/m²K]	0,09	
U-verdi tak [W/m²K]	0,08	
U-verdi gulv [W/m²K]	0,07	
U-verdi vinduer og ytterdører [W/m²K]	0,65	
Areal vinduer og dører delt på bruksareal [%]	13,9	
Normalisert kuldebroverdi [W/m²K]:	0,03	
Normalisert varmekapasitet [Wh/m²K]	159	
Lekkasjetall (n50) [1/h]:	0,50	
Temperaturvirkningsgr. varmegjenvinner [%]:	88	

Minstekrav enkeltkomponenter		
Beskrivelse	Verdi	Krav
U-verdi yttervegger [W/m²K]	0,09	0,15
U-verdi tak [W/m²K]	0,08	0,13
U-verdi gulv mot grunn og mot det fri [W/m²K]	0,07	0,15
U-verdi glass/vinduer/dører [W/m²K]	0,65	0,80
Normalisert kuldebroverdi [W/m²K]	0,03	0,03
Årsmidlere temperaturvirkningsgrad varmegjenvinner ventilasjon [%]	88	80
Spesifikk vifteeffekt (SFP) [kW/m³/s]:	1,50	1,50
Lekkasjetall (lufttetthet ved 50 Pa trykkforskjell) [luftvekslinger pr time]	0,50	0,60

Varmetapsbudsjett	
Beskrivelse	Verdi
Varmetapstall yttervegger	0,05
Varmetapstall tak	0,04
Varmetapstall gulv på grunn/mot det fri	0,03
Varmetapstall glass/vinduer/dører	0,09
Varmetapstall kuldebroer	0,03
Varmetapstall infiltrasjon	0,03
Varmetapstall ventilasjon	0,16
Totalt varmetapstall	0,44
Krav varmetapstall	0,50

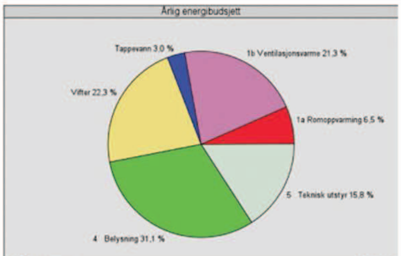
Varmetapsbudsjett (varmetapstall)



Varmetapstall yttervegger	0,05 W/m²K
Varmetapstall tak	0,04 W/m²K
Varmetapstall gulv på grunn/mot det fri	0,03 W/m²K
Varmetapstall glass/vinduer/dører	0,09 W/m²K
Varmetapstall kuldebroer	0,03 W/m²K
Varmetapstall infiltrasjon	0,03 W/m²K
Varmetapstall ventilasjon	0,18 W/m²K
Totalt varmetapstall	0,46 W/m²K

Energiytelse		
Beskrivelse	Verdi	Krav
Netto oppvarmingsbehov	11,3 kWh/m²	15,0 kWh/m²
Netto kjølebehov	0,0 kWh/m²	10,0 kWh/m²
CO_2-utslipp	10 kg/m²	25 kg/m²

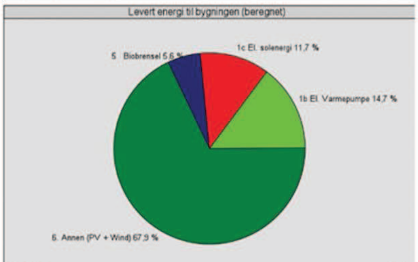
Årlig energibudsjett



1a Romoppvarming	2134 kWh
1b Ventilasjonsvarme (varmebatterier)	6938 kWh
2 Varmtvann (tappevann)	979 kWh
3a Vifter	7273 kWh
3b Pumper	0 kWh
4 Belysning	10122 kWh
5 Teknisk utstyr	5149 kWh
6a Romkjøling	0 kWh
6b Ventilasjonskjøling (kjølebatterier)	0 kWh
Totalt netto energibehov, sum 1-6	32596 kWh

Kostnad kjøpt energi		
Energivare	Energikostnad	Spesifikk energikostnad
1a Direkte el.	0 kr	0,0 kr/m²
1b El. Varmepumpe	1741 kr	2,8 kr/m²
1c El. solenergi	1383 kr	2,2 kr/m²
2 Olje	0 kr	0,0 kr/m²
3 Gass	0 kr	0,0 kr/m²
4 Fjernvarme	0 kr	0,0 kr/m²
5 Biobrensel	540 kr	0,9 kr/m²
6. Annen (PV + Wind)	8016 kr	12,9 kr/m²
Årlige energikostnader, sum 1-6	11679 kr	18,8 kr/m²

Levert energi til bygningen (beregnet)



1a Direkte el.	0 kWh
1b El. Varmepumpe	2176 kWh
1c El. solenergi	1728 kWh
2 Olje	0 kWh
3 Gass	0 kWh
4 Fjernvarme	0 kWh
5 Biobrensel	831 kWh
6. Annen (PV + Wind)	10020 kWh
Totalt levert energi, sum 1-6	14755 kWh