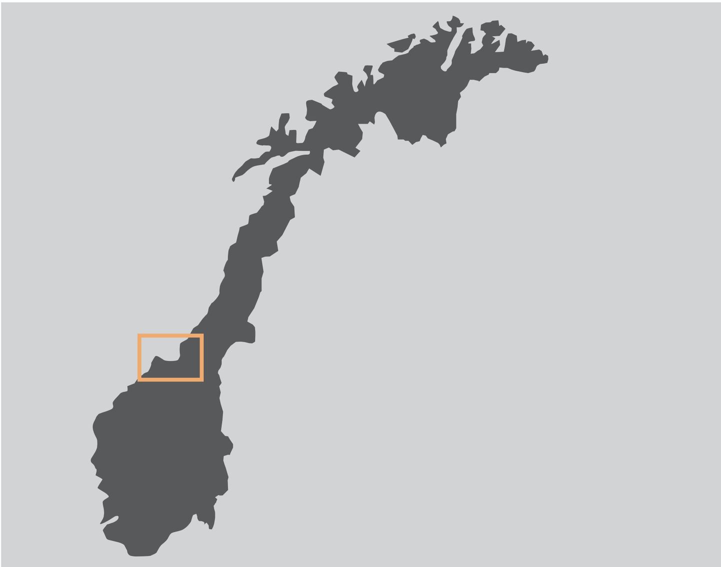
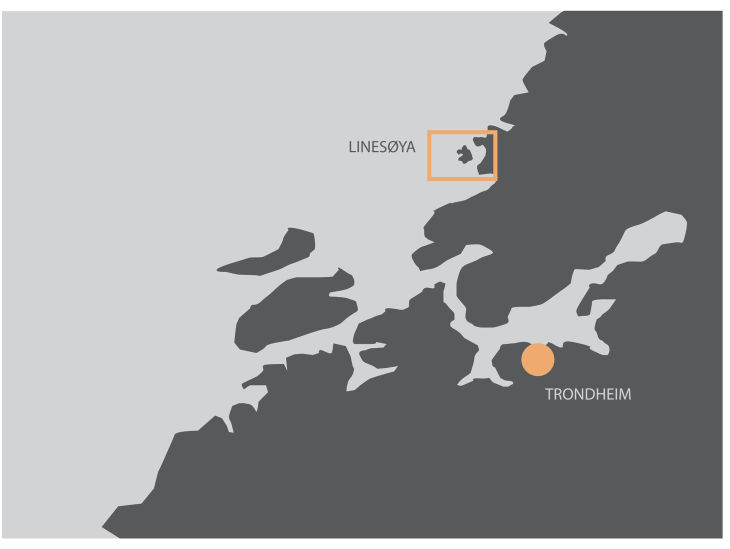
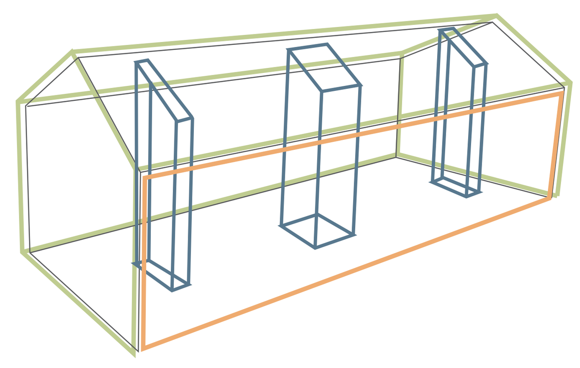




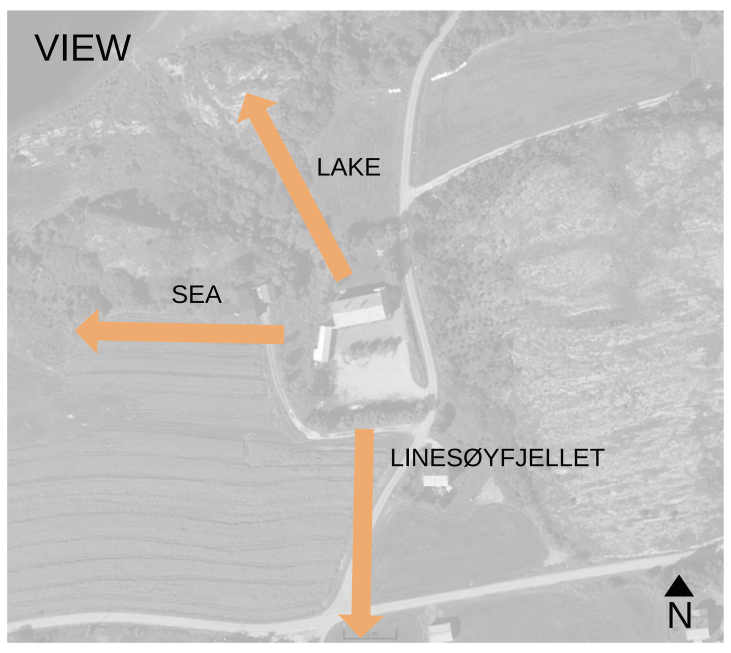
PASSIVEHOUSE LINESØYA

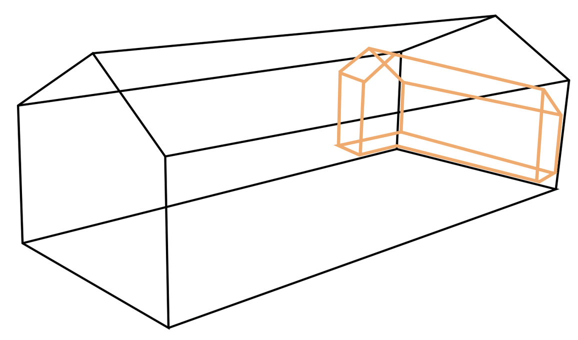
AAR4610 // SPRING 2010 // ELISABETH B. LANGRUSTEN // TRULS Y. KANNELØNNING // INGRID T. HELLEVE



MAIN CONCEPT

- SHELL:
  - weather protection
- SCREEN:
  - active & passive solar energy collector
- CORE:
  - vertical shaft
  - thermal mass
  - structural element

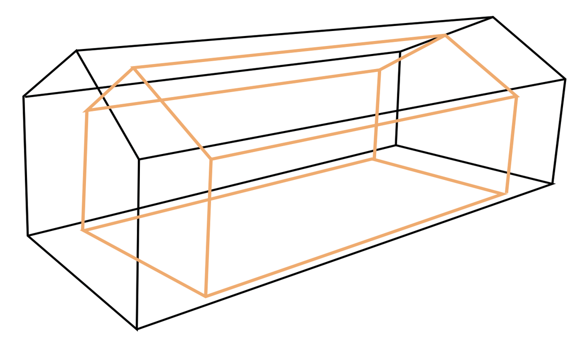




CONSTRUCTION

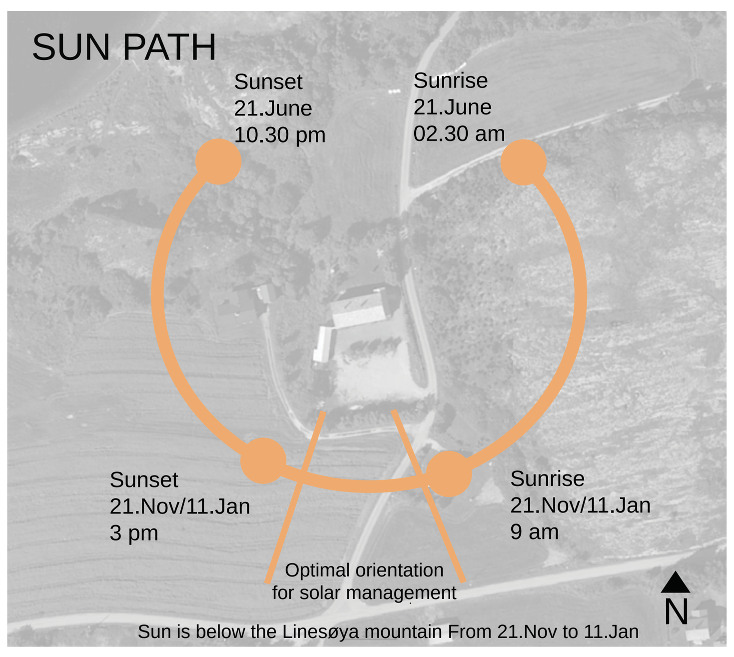
- REMOVE

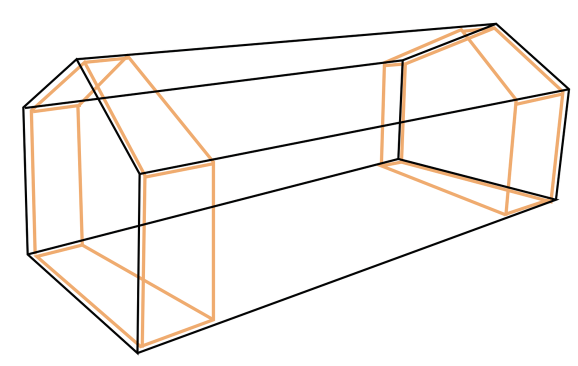
SITUATION PLAN 1:200



CONSTRUCTION

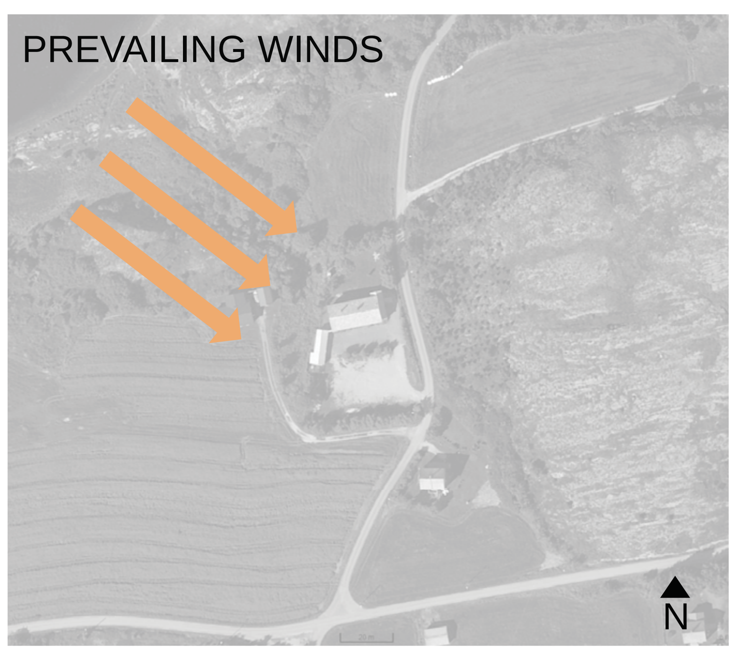
- EXCISTING BUILDING

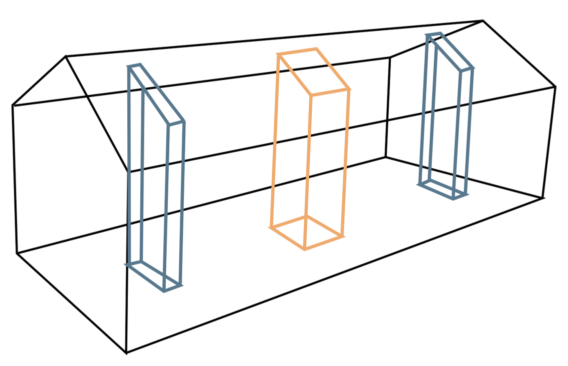




ORGANISATION

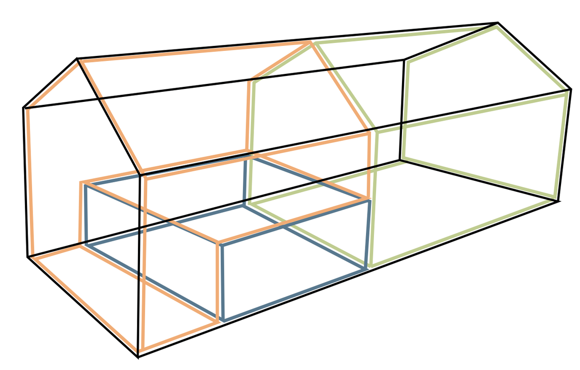
- EXTENTION
  - entrance area
  - sun space
  - vertical transport





ORGANISATION

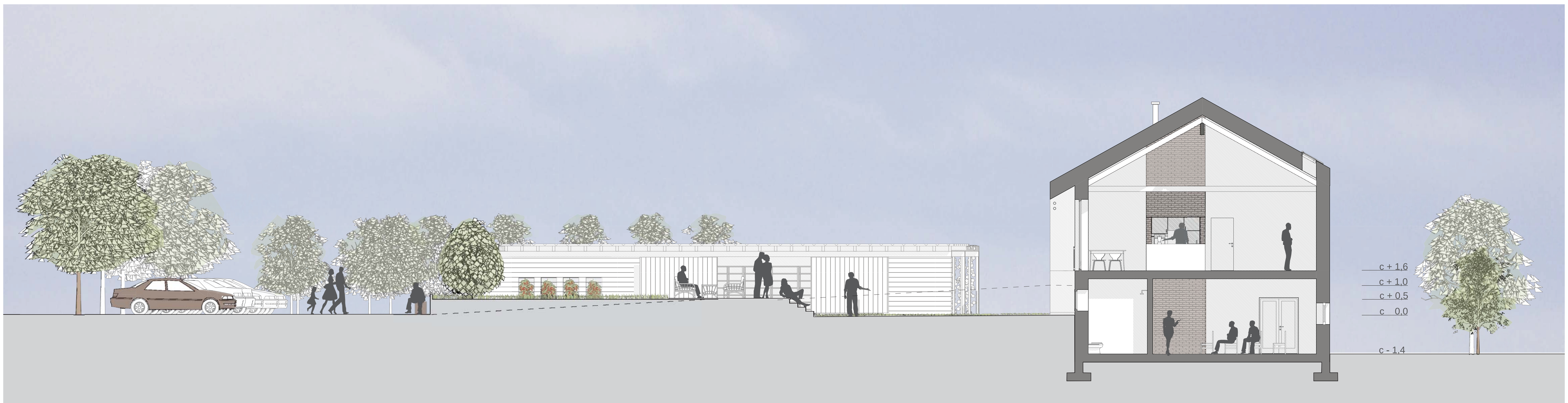
- FIXED ELEMENT
  - constructive element
  - thermal mass
  - technical system
- FIXED ELEMENTS
  - constructive element
  - fire place
  - vertical shafts



ORGANISATION

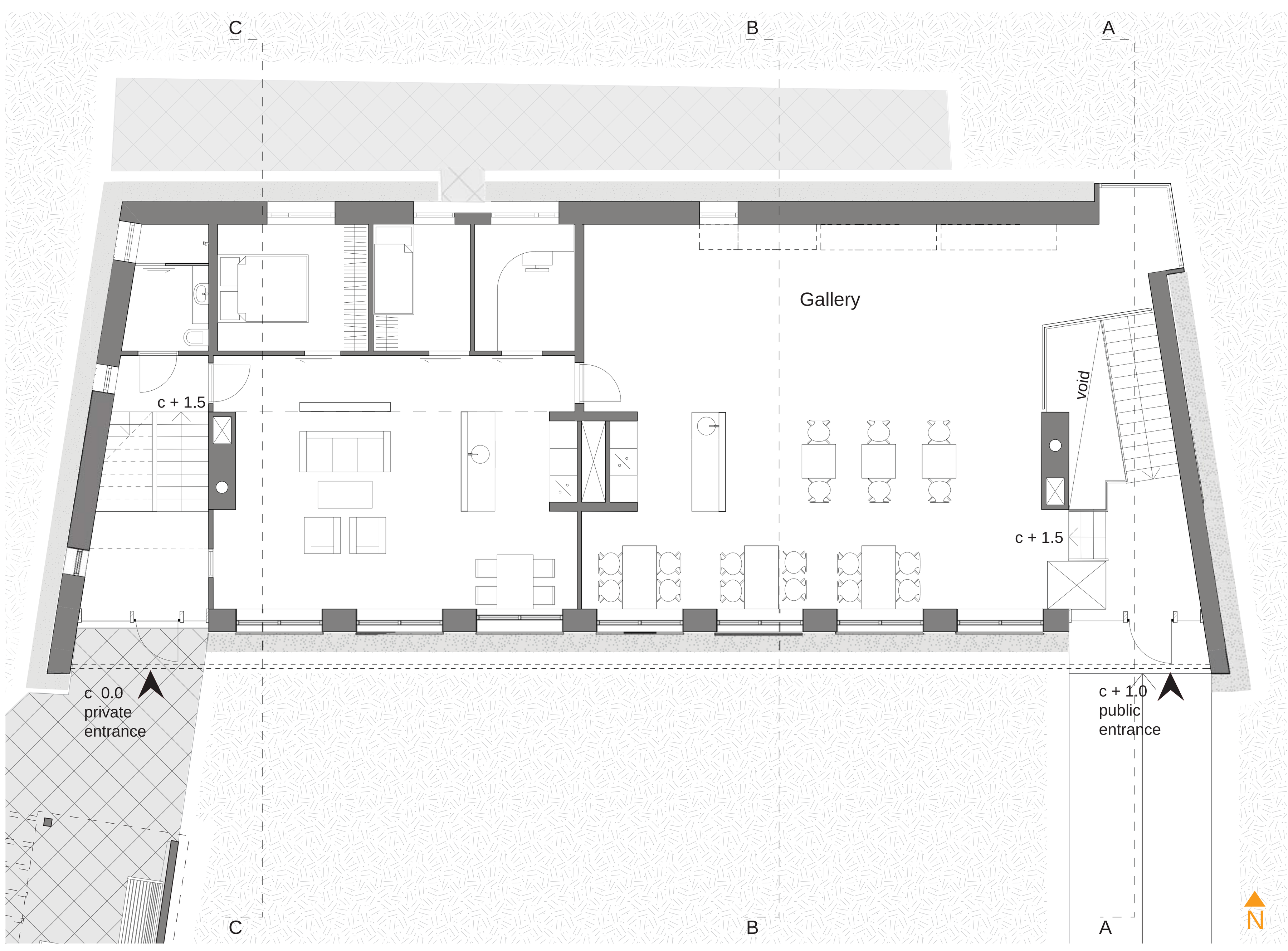
- PRIVATE
- SEMI-PUBLIC
- PUBLIC

SECTION A-A 1:100

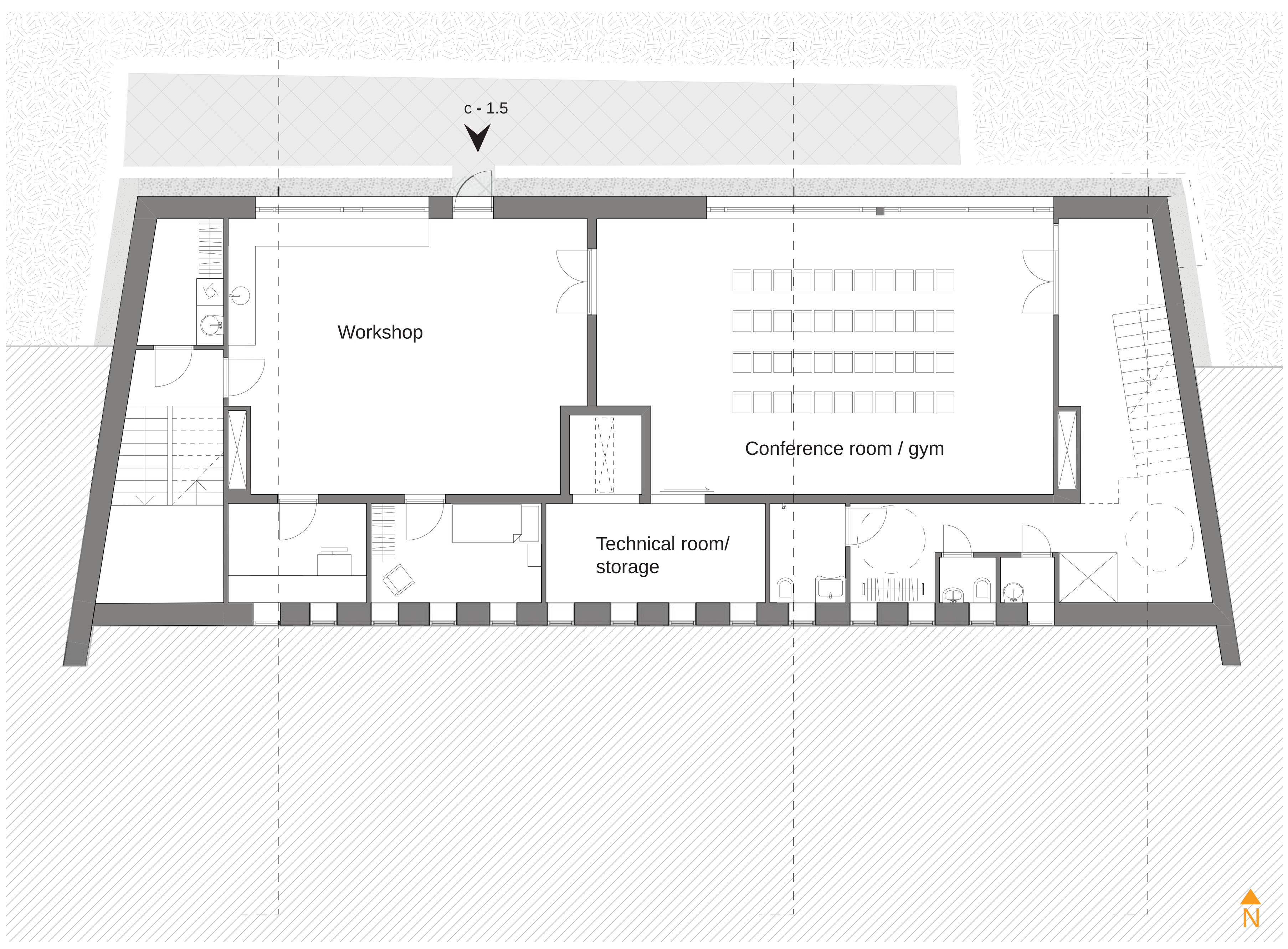


SECTION B-B 1:100

SECTION C-C 1:100



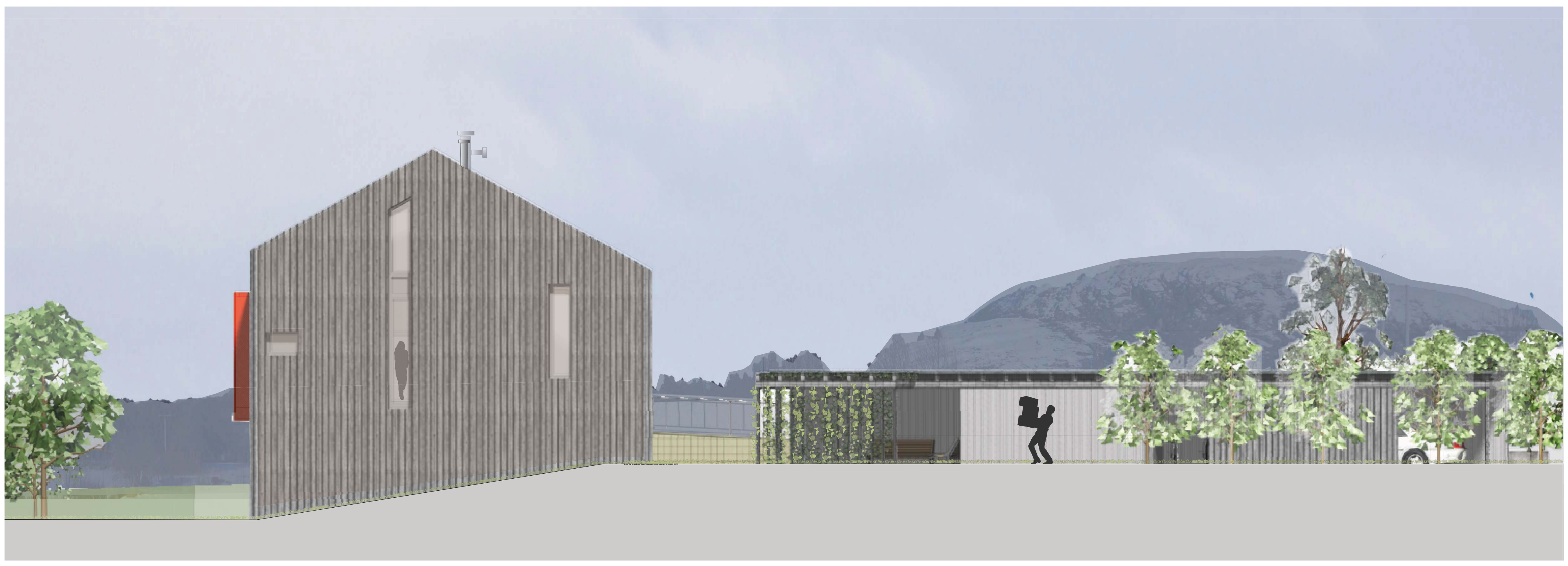
PLAN, FIRST FLOOR 1:100



PLAN, BASEMENT 1:100

SOUTH ELEVATION 1: 100

NORTH ELEVATION 1:100



WEST ELEVATION 1:100

EAST ELEVATION 1:100

Roof:

98 x 198 mm beams
98 x 198 mm rafters
98 x 98 mm beams
22 mm plywood
2 mm vapour barrier
400 mm wood fibre boards
wind barrier
36 mm furring
36 mm furring
36 mm horisontal furring
22 mm vertical cladding

10 x 30 x 20 mm steel
T-profile

insulation is fastened
with screws

Wall:

60 mm vertical vertical
feather-and-tongue timber
2 mm vapour barrier
50 mm insulated timber
framework
30 mm woodwool board
200 mm wood fibre mat
75 mm wood fibre mat
wind barrier
28 mm vertical furring
25 mm horisontal furring
22 mm vertical cladding
3-layer insulated glass w/
double glazing and
insulated frame

venetian blinds

Floor:

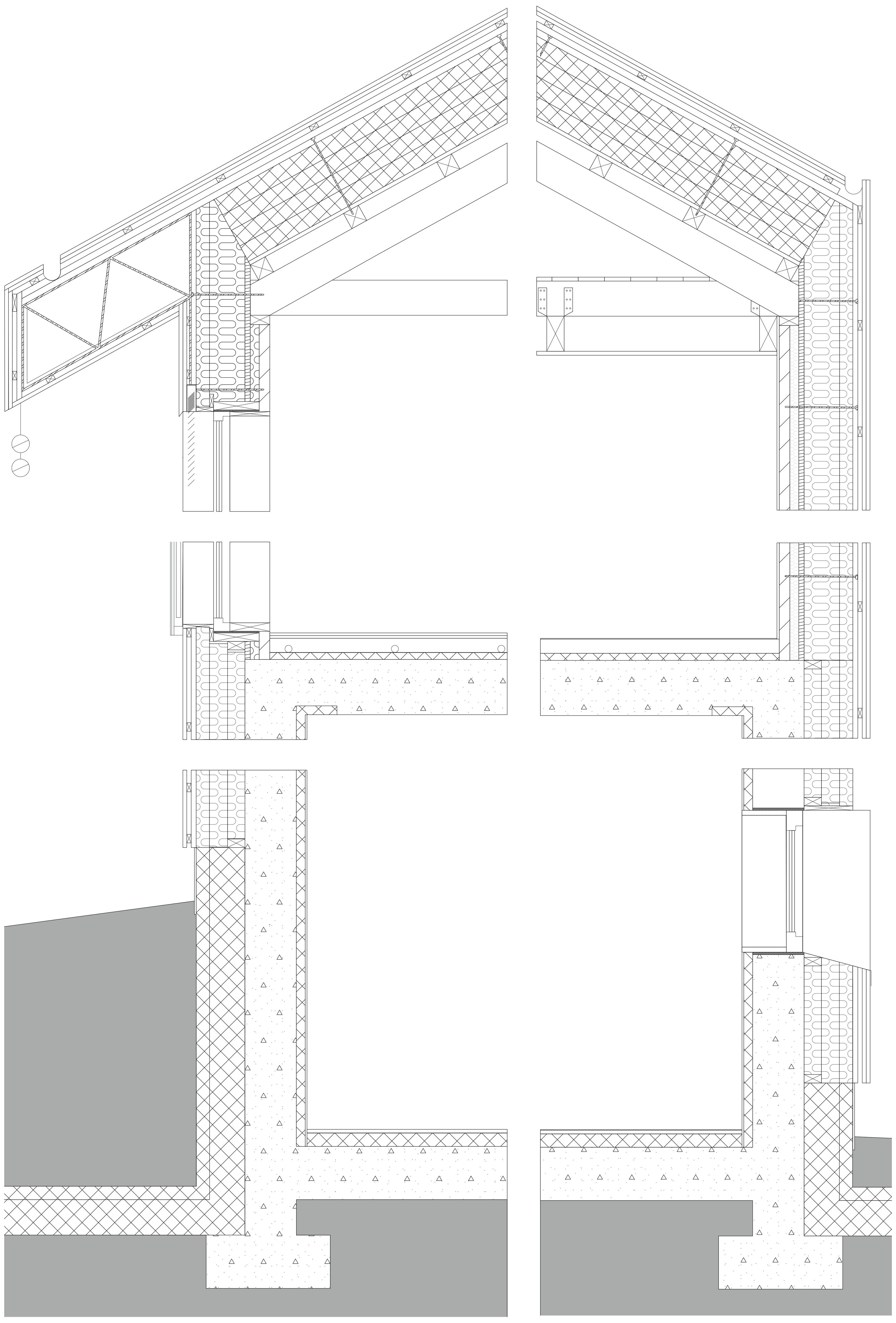
300 mm concrete
40 mm sound insulation
1 mm separating layer
80 mm screed w/ heating
15 mm mortar bed
15 mm slate

Basement wall:

10 mm plaster
50 mm woodfibre- and
concrete board
290 mm concrete
48 x 98 insulated timber
framework
100 mm wood fibre mat
75 mm wood fibre mat
wind barrier
28 mm vertical furring
25 mm horisontal furring
22 mm vertical cladding

Basement floor:

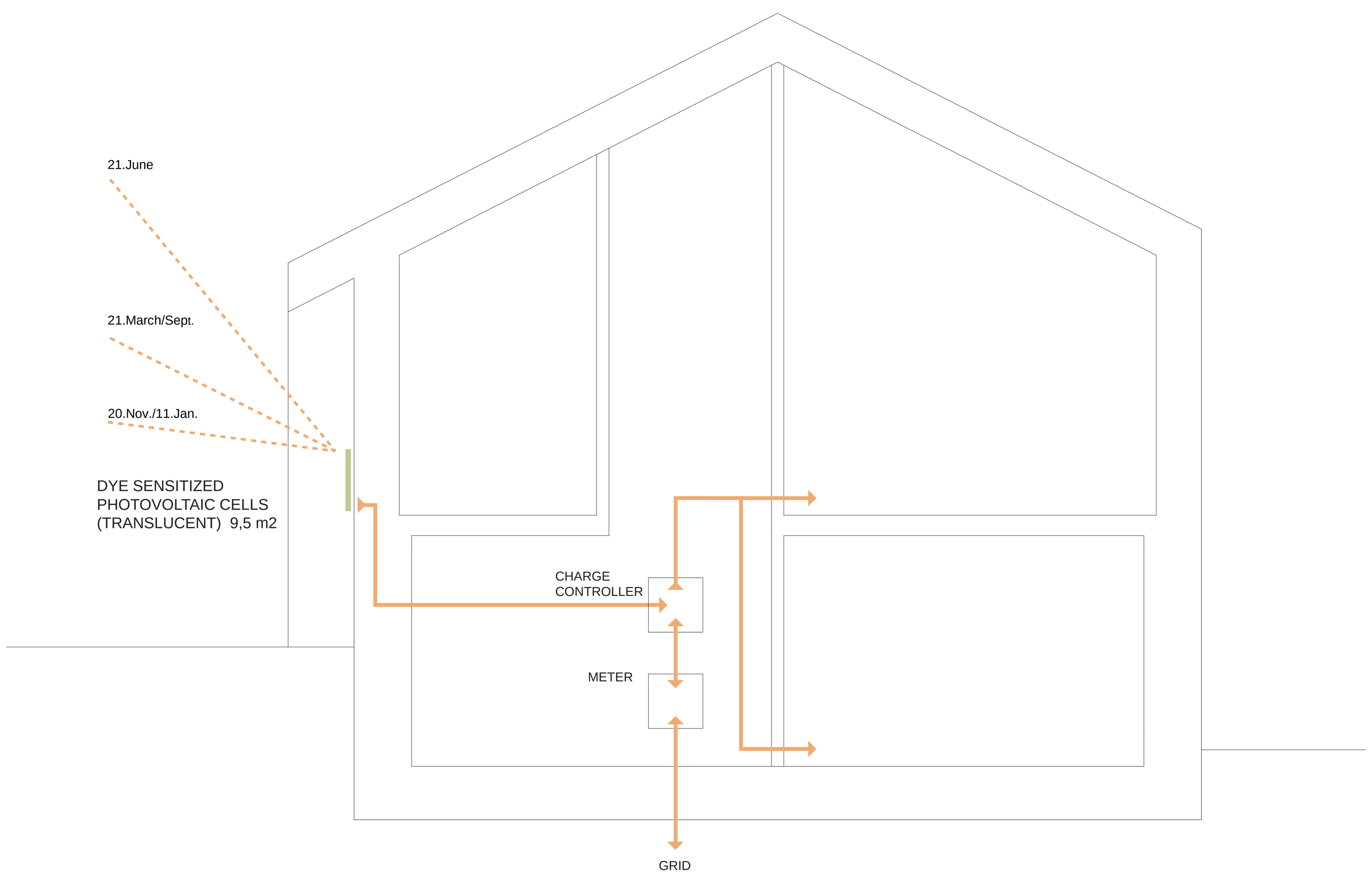
300 mm concrete
75 mm insulation
20 mm screed
4 mm lineoleum



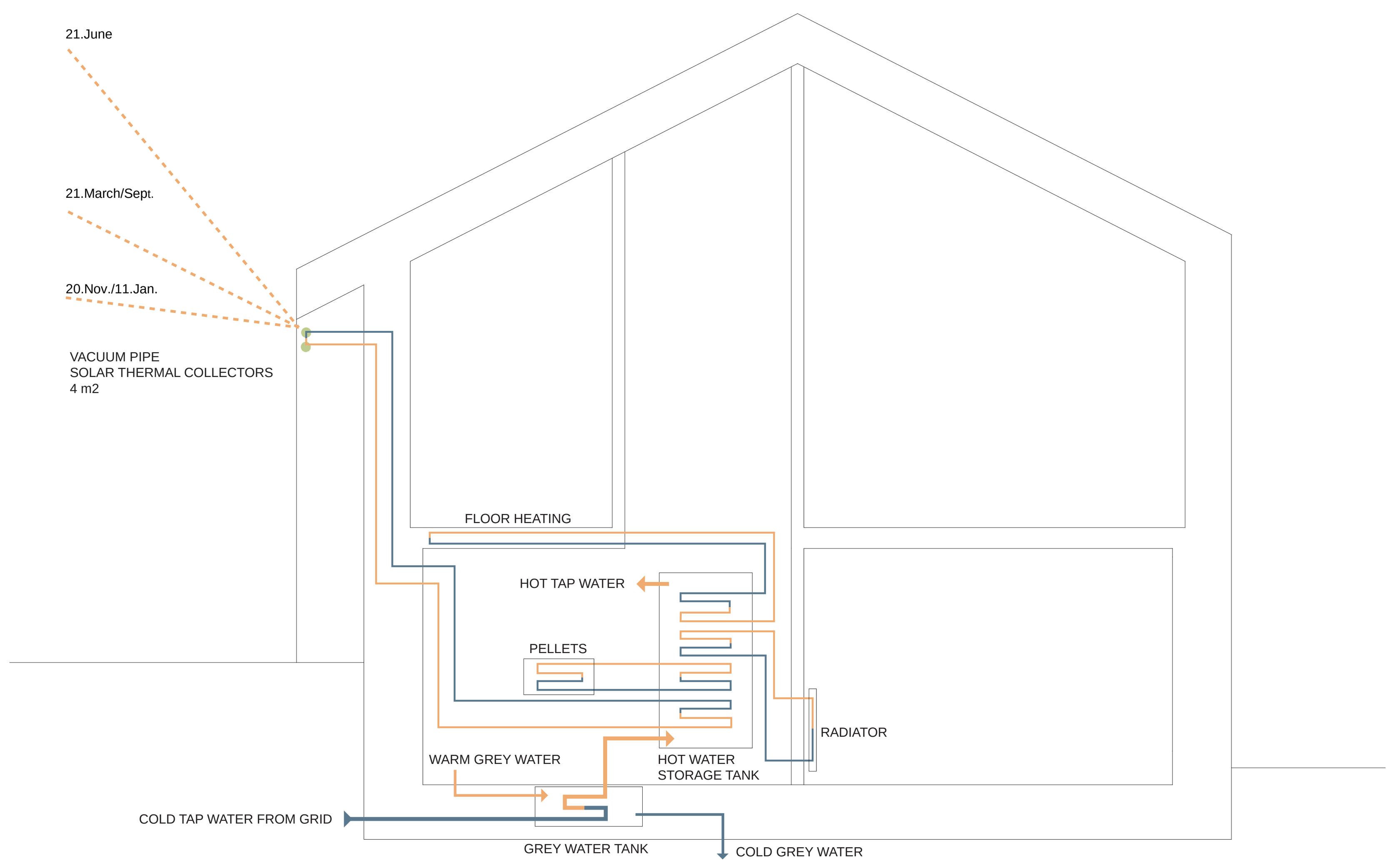
DETAIL SECTION 1:20

MATERIALS	EXISTING	REUSE	NEW
CONSTRUCTION	Concrete foundation + vertical feather-and-tongue timber + timber framework	The main construction is kept as it is. The concrete of the staircased will be reused as aggregate in new concrete foundations or filling coumpound.	Additional construction of timber framework.
INSULATION	50 mm mineral wool + 30 mm woodwool board	The excisting insulation will be kept, provided that its in OK condition. Additional insulation will be added to the structure	275 mm wood fibre mats will be added.
CLADDING	Painted timber cladding + roof slate	The cladding will be reused in the new outdoor structure. The slate will be reused as floor in parts of the building and the outdoor area.	Pine heartwood will be used for new cladding + roof
CORE ELEMENT	---	The bricks from the existing chim-neys will be reused for the fixed core elements.	Additional brick will be collected from demolition projects in the region.
WINDOWS + DOORS	Double glass, framing and U-value unknown.	The window glass will be reused for indoor windows + railings and for garden greenhouses. Interior doors can be reused with necessary improvements to ensure airtightness/ sound proofing.	Tripple glass windows with double energy glazing and gas filling. New airtight doors.
OUTDOOR STRUCTURES	Uninsulated timber framework + timber cladding	The excisting shed will be dissas-sembled, and the material + old fasade cladding will be reused for the new structure.	The addition of some new material for timber framework will be neces-sary.

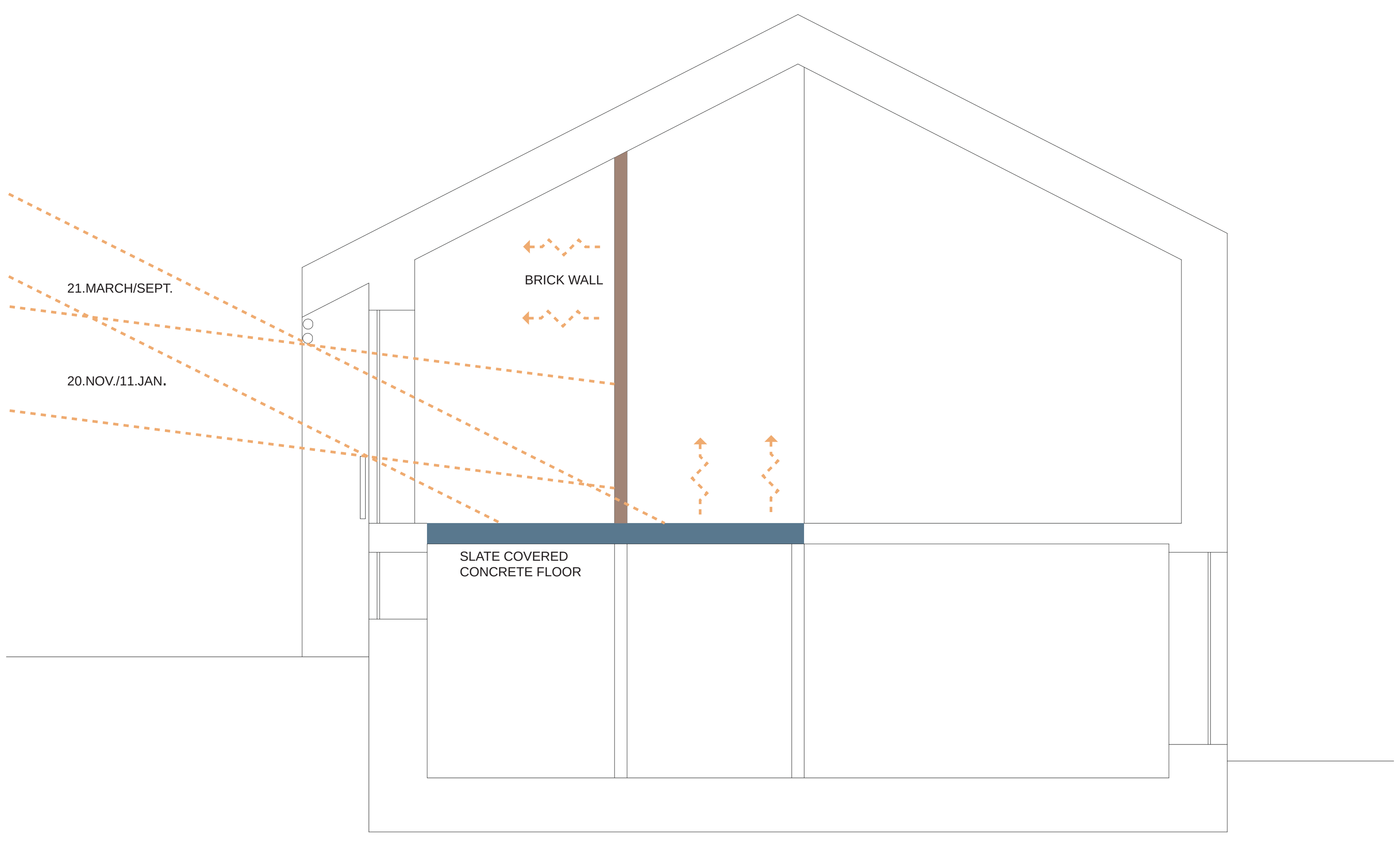
ELECTRICITY



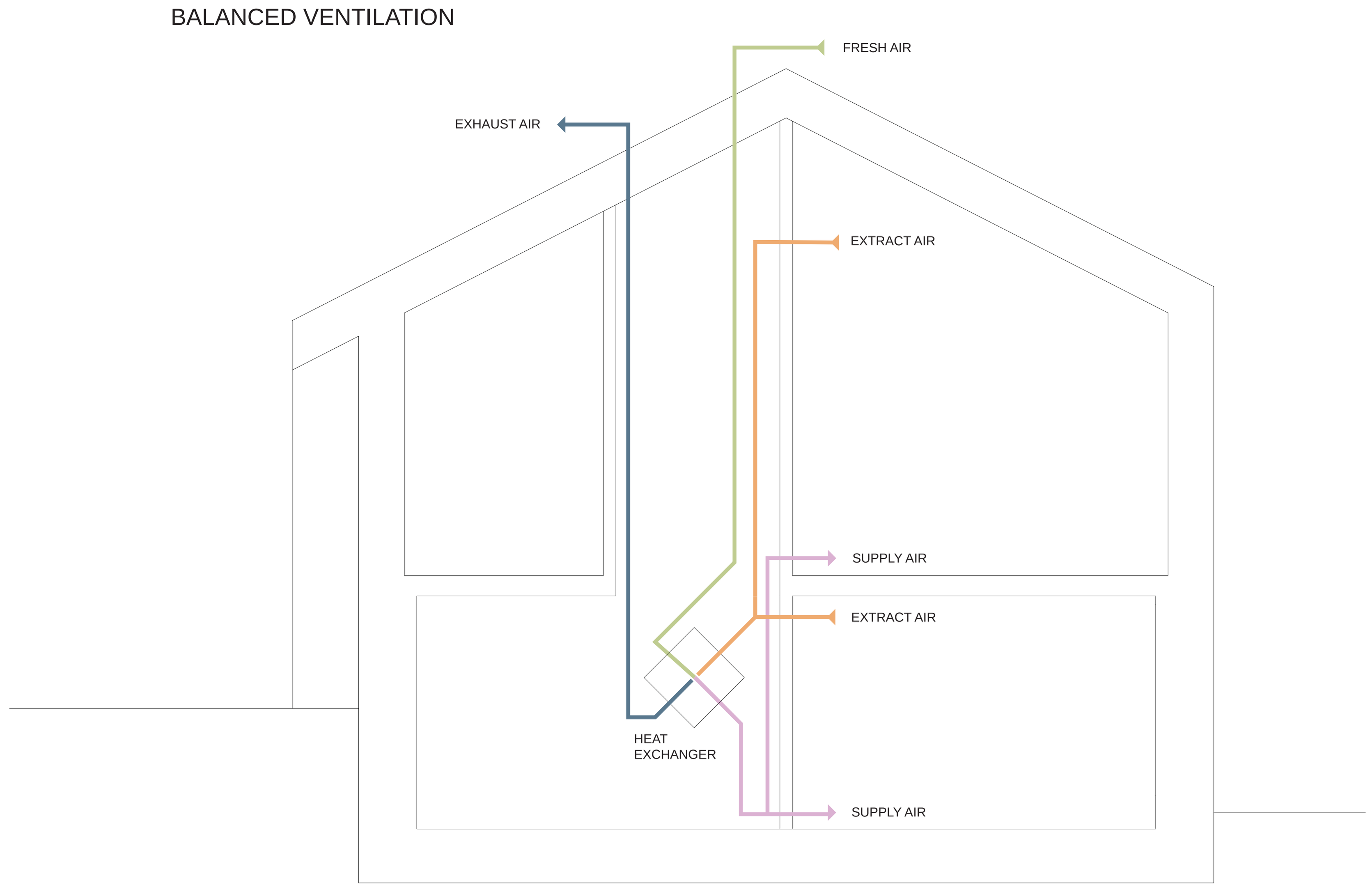
WATER & SPACE HEATING



THERMAL MASS



BALANCED VENTILATION



CO^2- CALCULATIONS

Material	m3	kg Co2-emission from production	kg Co2 stored in the products	kg Co2 -emission for transport
Concrete (foundation, slabs)	50,4	21770	2419	343
core wood, pine (cladding)	14,7 / 2,0*	2337/ 742	6622/ 928	115/ 115
insulation	229	10300	8244	5100
brick (fixed core elements)	24	—	—	115
timber framework/ furring	9,5	1420	4280	115
outdoor wood construction	8,5	1275	3829	115

*Cladding in south facade, painted wood cladding

The calculation of CO2 emission is based conventional
production with fossil fuels and electricity
the municipal grid in OECD-countries.
The use of bio energy or hydropower in p
is not reflected in the estimates.

The calculation of CO2 storing is based o
over a 50 year period.
In the sum up.
In the total estimation of CO2 emission it i
interesting, and important to look at factor
maintenance, disassembling, and oxidatio
factors are not taken into measure in this
ment, due to shortage of time and sources

HEATING DEMAND CALCULATIONS

Our main focus has been to document our designs potential to reach the passivehouse standard, which is less than 15 kWh/m2 energy use for space heating. To do the calculations we used Ecotect.

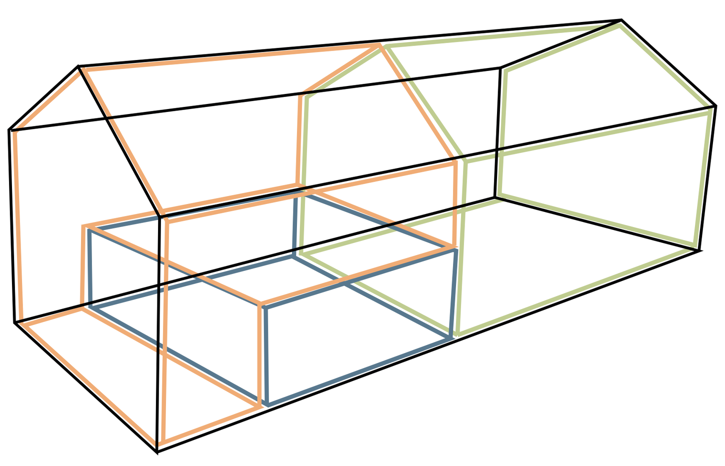
To make the calculations as accurate as possible, we divided the model into three thermal zones. We programmed different schedules for each zone. To estimate internal heat gains we also made a rough assumption of the amount of people using each zone. Even if these are note exact numbers they will help making the results more close to reality.

A 95% effect heat exhanger is included in the calculations .

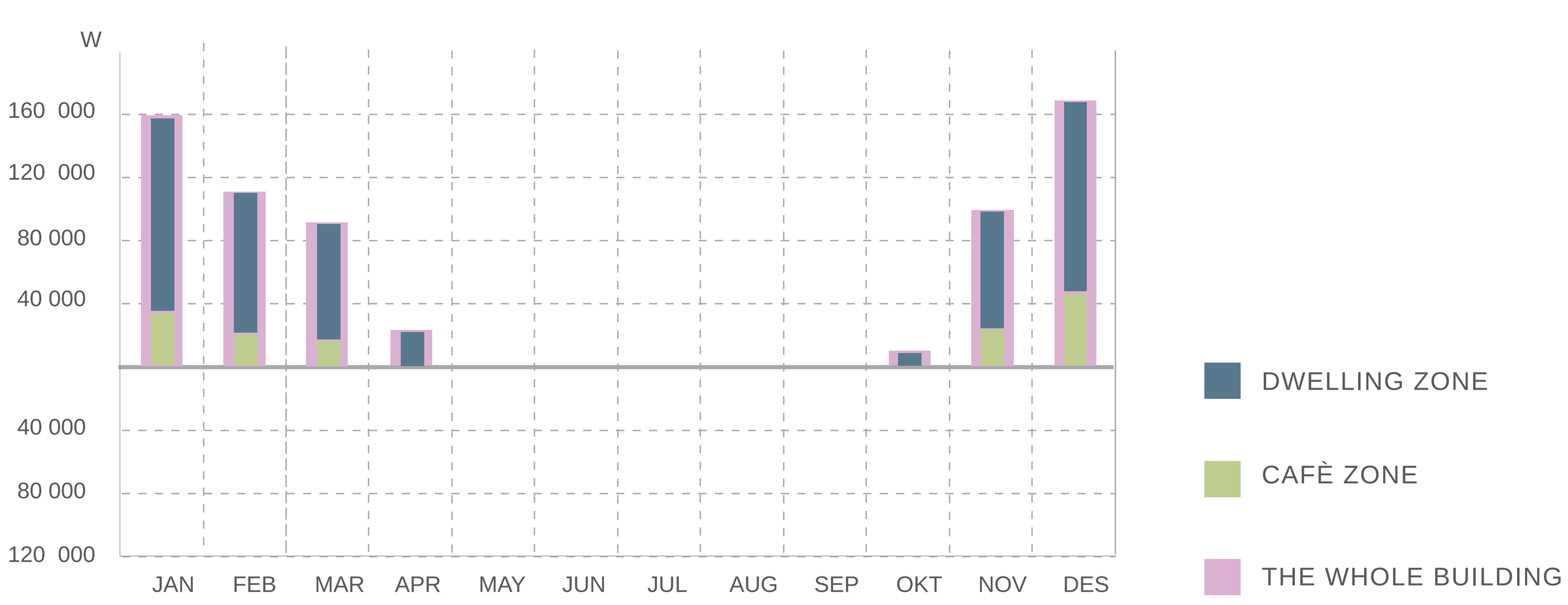
1.DWELLING
In use all year around.
Number of people: 2

2.CAFE
Steady all day use during summer season(may - september).
More sporadic use the rest of the year.
Number of people: 15

3.BASEMENT(gym/conference/workshop)
Steady all day use during summer season(may - september).
Steady afternoon use the rest of the year.
Number of people: 8



CALCULATED ENERGY DEMAND FOR HEATING



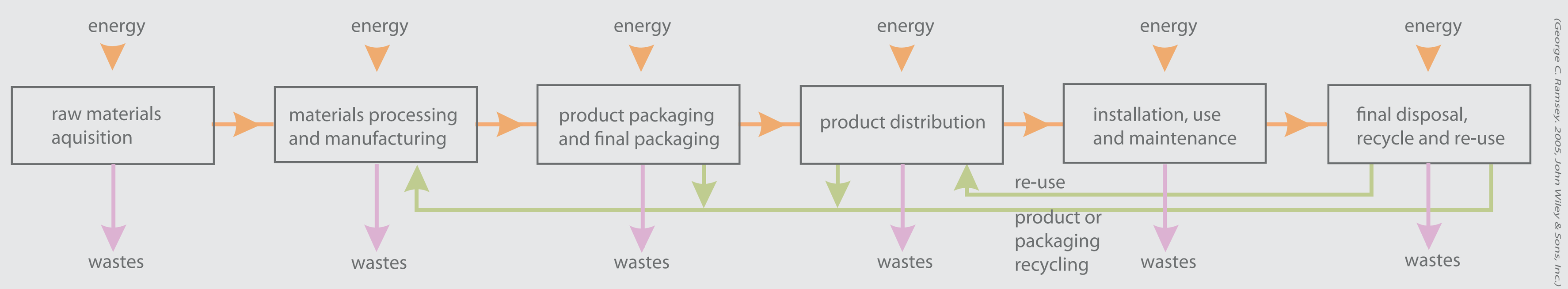
COMMENTS TO THE CALCULATIONS

Dwelling: 17,7 kWh/m2
Cafe: 3,9 kWh/m2
Basement: 2,1 kWh/m2
Overall: 5,0 kWh/m2

We can se the difference in energy use is large between the different zones. The main reason why Cafe and Basement has such low numbers compared to the dwelling is because they are unheated a large amount of the year.

According to these calculations the house as a whole would reach the passivehouse standard.

LCA ANALYSIS, WOOD FIBRE INSULATION



The raw material for wood fibre insulation is mainly low quality softwood. Recycled wood material can also be used. Corn flour based products are used as binders. Transport of raw material amounts to a significant part of the total energy consumption.

The energy consumption of the raw material aqusition creates CO2-emissions mainly through transport.

The production process concists of several steps: cutting, washing and steaming of wooden chipping, and a drying process. The conventional production process uses 50/50 % fossil and electrial energy.

The use of fossil based energy sources will create Co2-emissions. The temperature needed for the production does not exceed 200 degrees celcius,

The packaging process requires energy for electrical or fuel based machinery.

The production and transportation of plastic packaging generates waste.

The transport of the material requires energy, mainly fossil based. The travel distance will be decisive for the energy demand for the product distribution.

When importing the material from Germany, this will give a CO2-emission of 1700 kg CO2. The transport of the material is a factor that pulls down the energy accounting. For this pilot project we

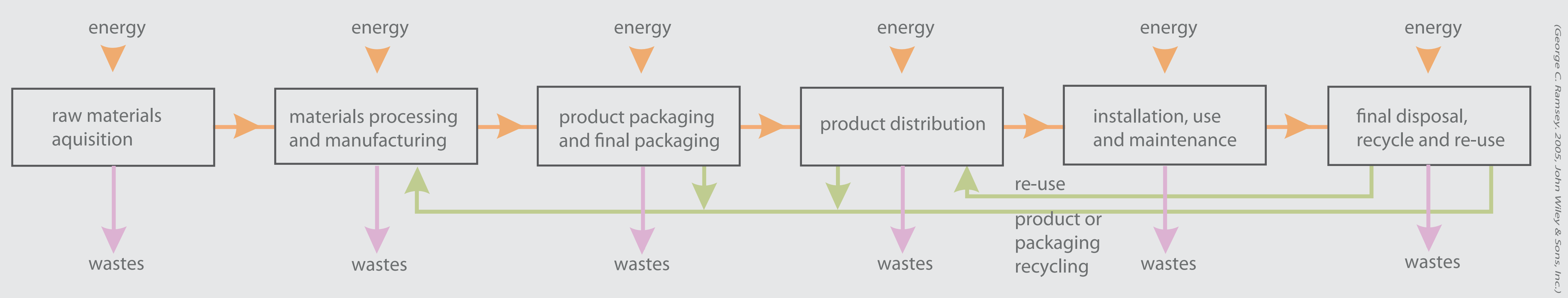
The installation of the insulation requires weather protection to prevent moisture damages to the material. The transport and installation of a tent and a scaffold requires energy.

The transport of tent and scaffold creates CO2- emissions. Because wood decomposes and stores CO2 in its biomass, wood products are CO2 neutral. Through its

Wood fibre mats can be reused. The material can also be recycled as raw material for new wood fibre insulation, or paper production. This process requires energy. Energy recovery is another alternative for disposal.

Binders based on corn does not generate harmful waste in a disposal process.

LCA ANALYSIS, BRICK



The brick is reused from demolition projects in the Trondheim region. Because the brick is for indoor use and will not be exposed for weather, the quality of the collected brick is less important. Lime mortar is used as binder. Lime is a non-renewable resource, but the reservoar in the world today is listed as “very large”.

The brick needs to be cleaned from the original mortar. This process requires energy.

Waste from the cleaning process is the old mortar.

Transport of the collected material requires fossil based energy.

The transport from demolition site to Linesøya generates CO2-emissions.

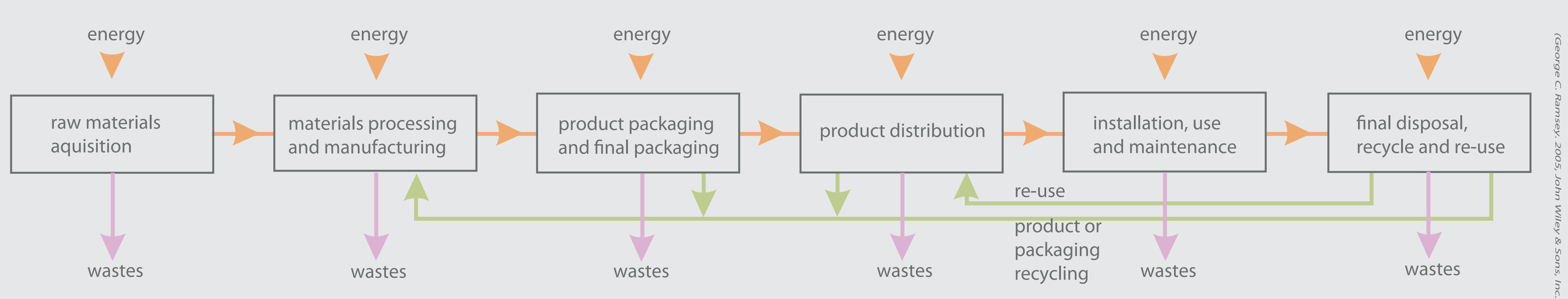
When installing the bricks, new mortar needs to be made on site. The compound process depends on electrical energy. Brick is considered maintenance free, especially since it’s not exposed for weather strain.

The energy consumption of the installation process will generate a small amount of CO2-emissions.

The lifetime of brick is considered as 100 years +. When using lime mortar, the bricks can be disassembled and reused at a later time.

In the case of reuse, the mortar will become waste.
The bricks can also be demolished and used as aggregate or compound filling.

LCA ANALYSIS, TIMBER CLADDING



The raw material used in this project is collected in the region. The use of regional material reduces the need of energy for transport of the raw material. Timber is a renewable material.

The CO2-emissions generated from the raw material aqusition is mostly from transport of material from the woods to the saw mill.

The refining consists of cutting and planing of the material, which requires energy. The production process in Norway is mainly based on renewable energy sources as hydro power. Timber has a “negative energybalance”, which means that it produces more potential energy in the form of biofuel products than what is required for the material processing.

The processing of the materials produces a low amount of biological waste. This can be used as potential energy for the production process.

The packaging process requires energy for electrical or fuel based machinery.

The production and transportation of plastic packaging generates waste.

The product distribution is basically transport, wich requires fossil energy.

The transport of the material creates CO2-emissions.

The installation of the corewood cladding requires a low amount of energy. Fixings are needed, the production of this demands energy. The installation equipment requires use of energy.
The corewood does not require regular maintenance during its lifetime.

Timber has a negative CO2-emission through its life cycle.

The material can be re-used or recycled, depending on its condition when it’s disassembled. If it is not possible to reuse the cladding, it can be disposed of for energy recovery, or in cellulose insulation materials.