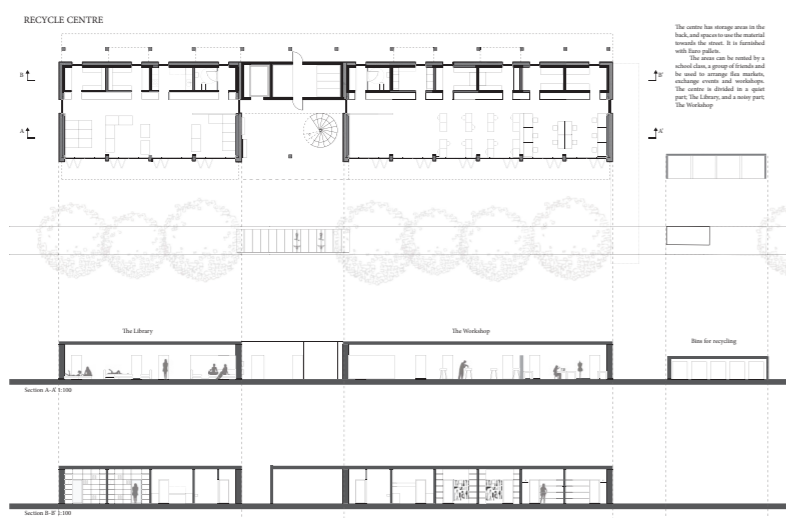
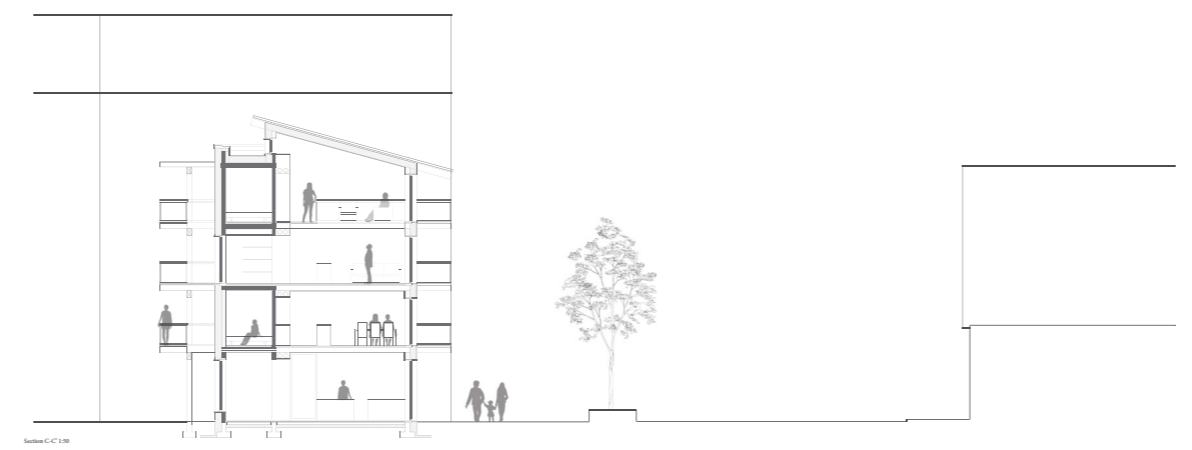
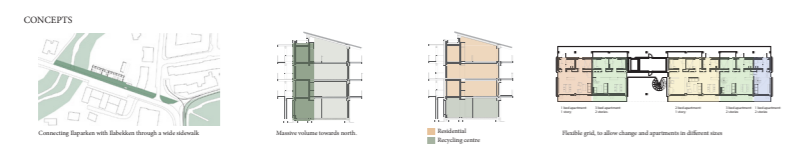
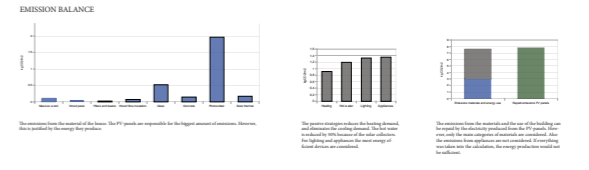
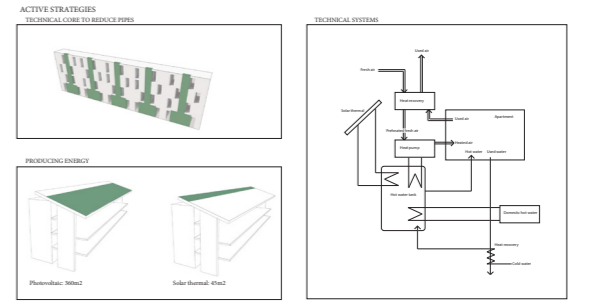
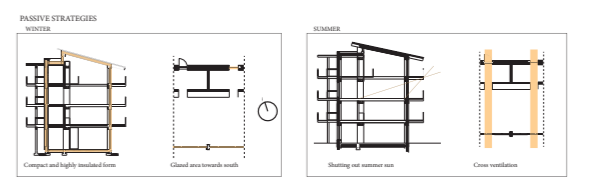
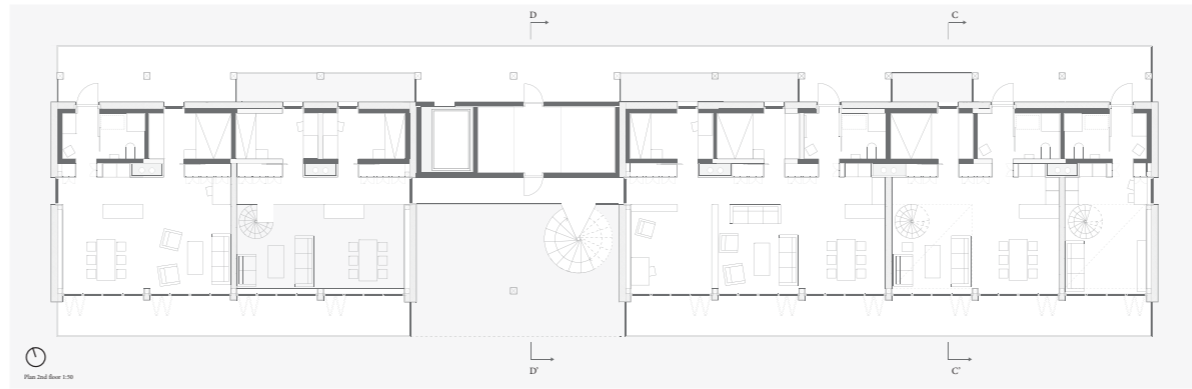


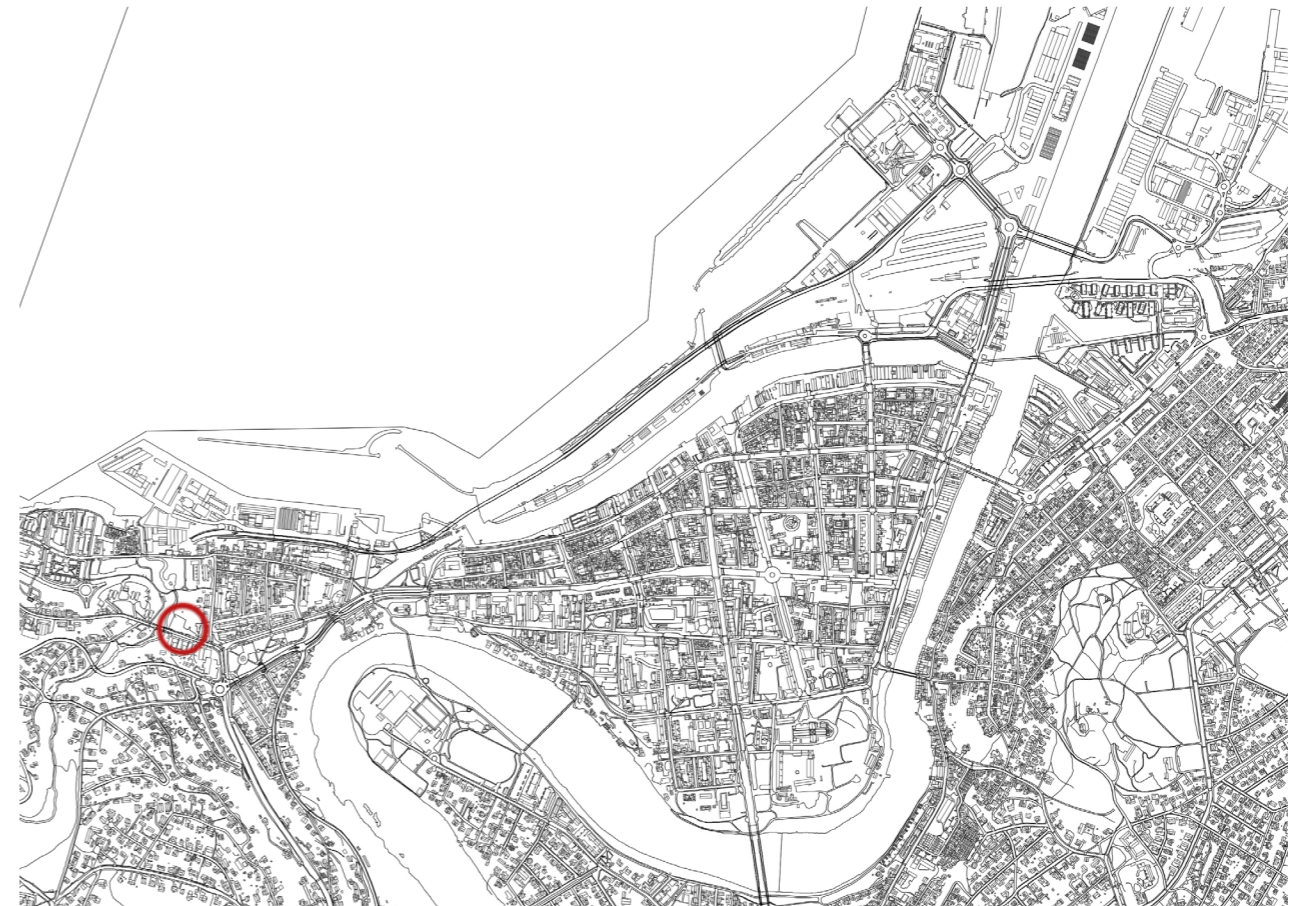
# LOW EMISSION LIVING

HEIDI LARSSON KLEVELAND



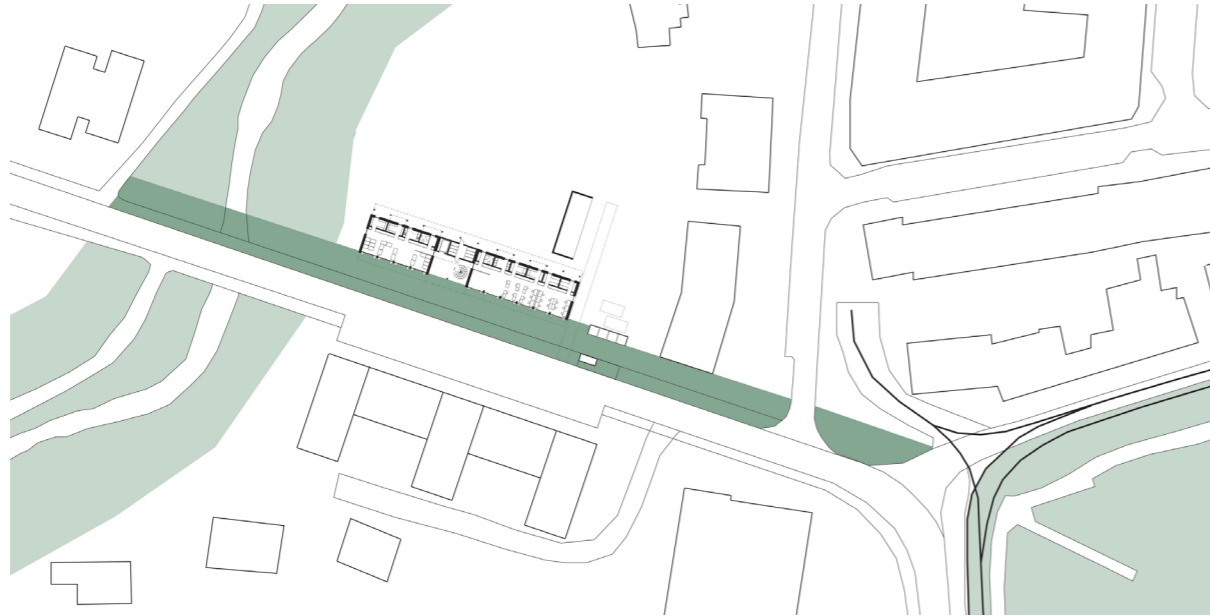
## SITUATION

The buiding is situated in Trondheim, in the city part called Ila. This site was chosen because it is close to the centre and very well connected through public transport. This makes it easier to live without a car.

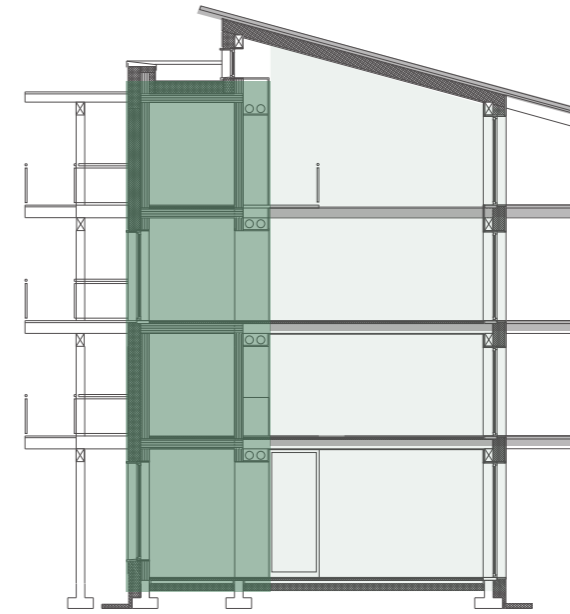




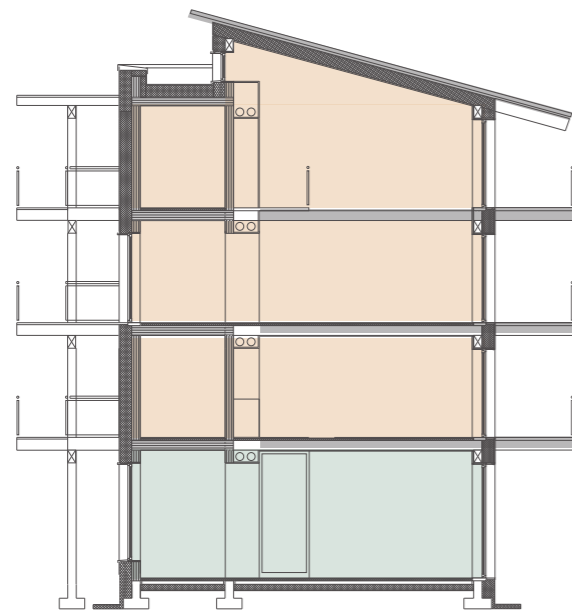
# CONCEPTS



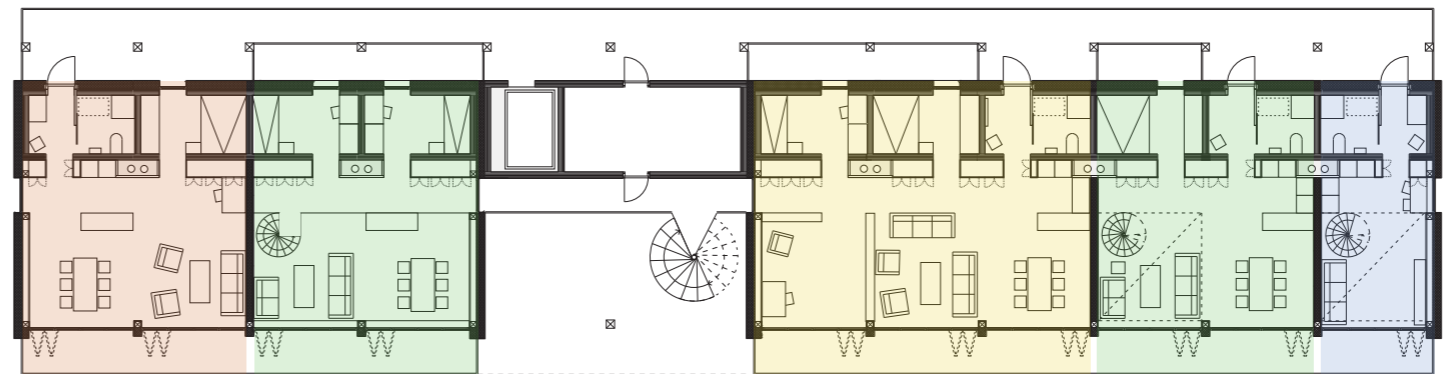
Connecting Ilaparken with Ilabekken through a wide sidewalk



Massive volume towards north. It contains the most private rooms of the home; the bedroom and the bathroom.



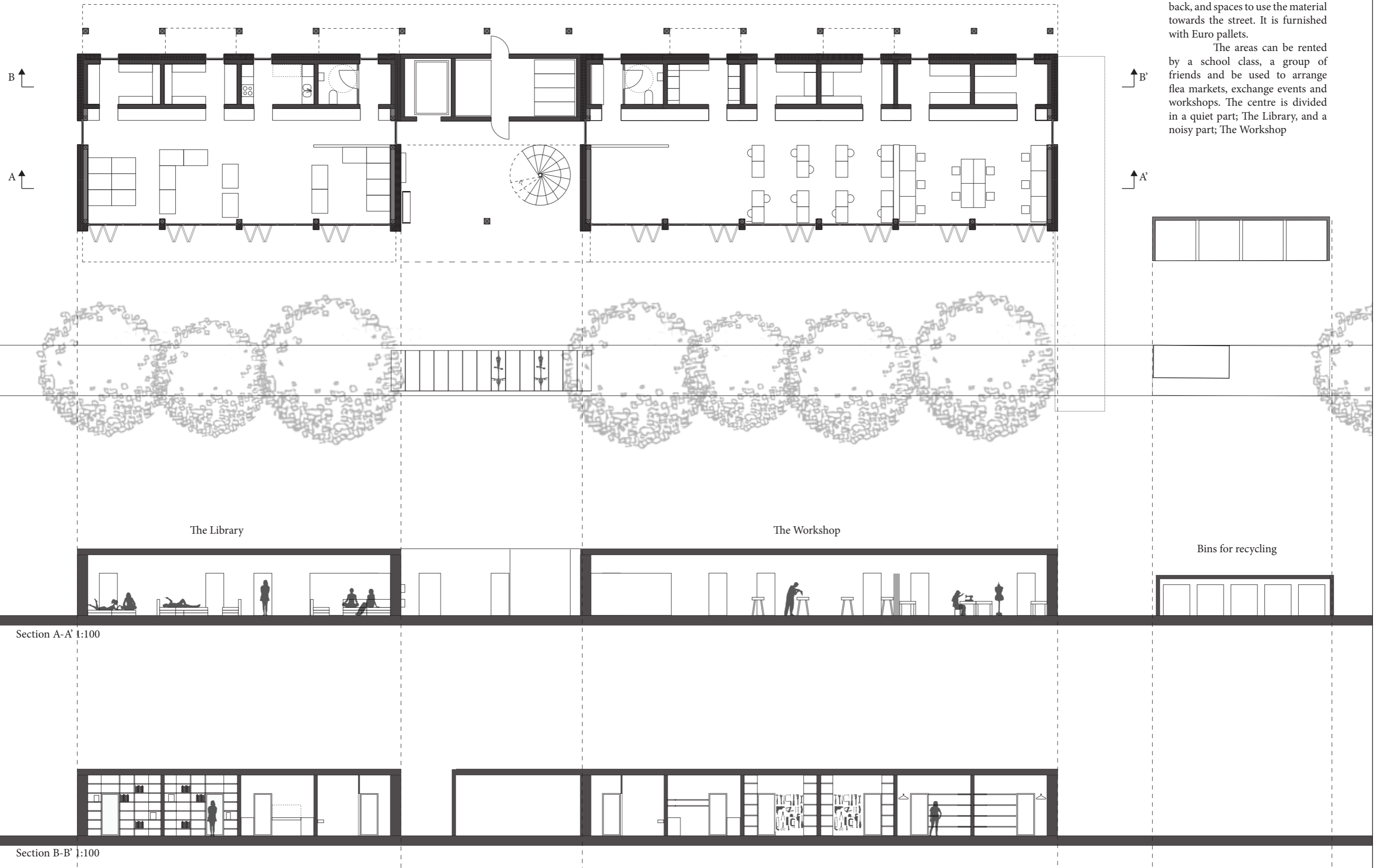
Residential  
Recycling centre



1 bed apartment 1 story    3 bed apartment 2 stories    2 bed apartment 1 story    3 bed apartment 2 stories    1 bed apartment 2 stories

Flexible grid, to allow change and apartments in different sizes

# RECYCLE CENTRE



The centre has storage areas in the back, and spaces to use the material towards the street. It is furnished with Euro pallets.

The areas can be rented by a school class, a group of friends and be used to arrange flea markets, exchange events and workshops. The centre is divided in a quiet part; The Library, and a noisy part; The Workshop

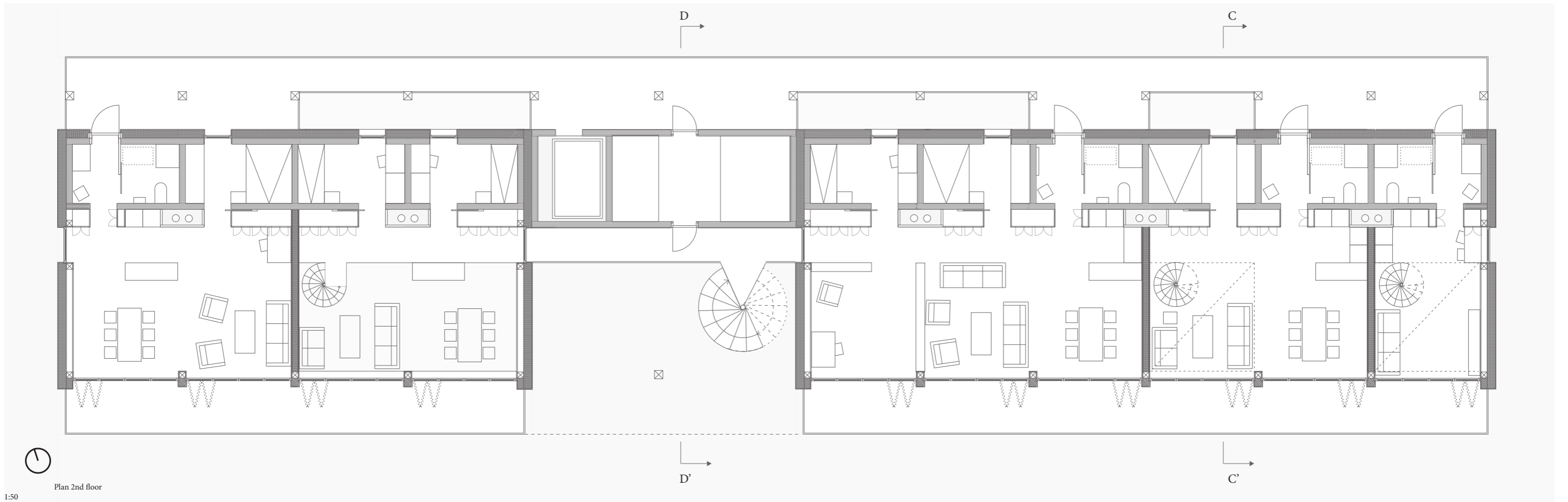
The Library

The Workshop

Bins for recycling

Section A-A' 1:100

Section B-B' 1:100



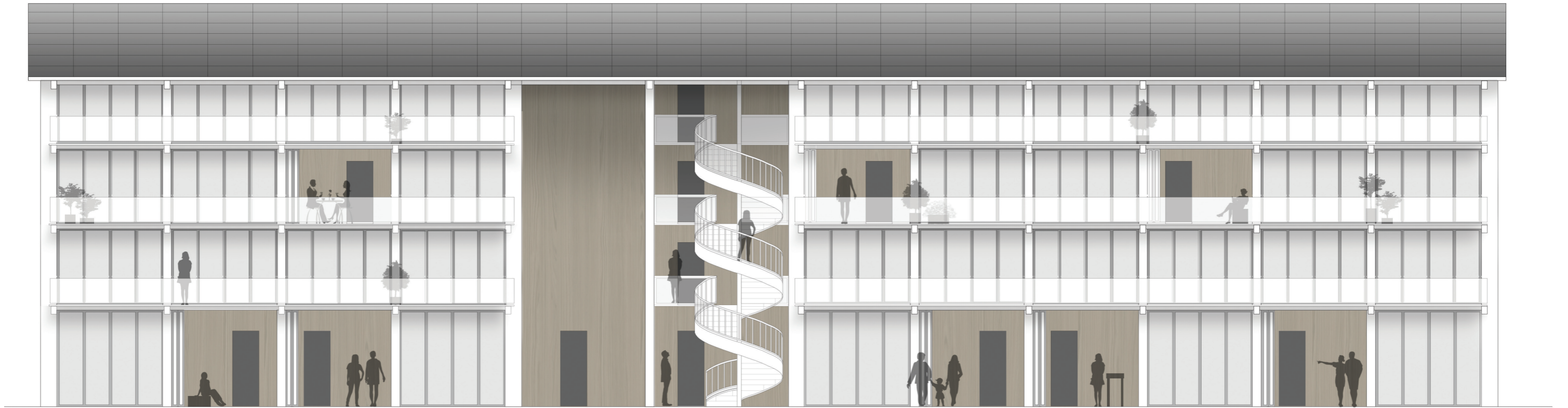
Plan 2nd floor

1:50



North facade

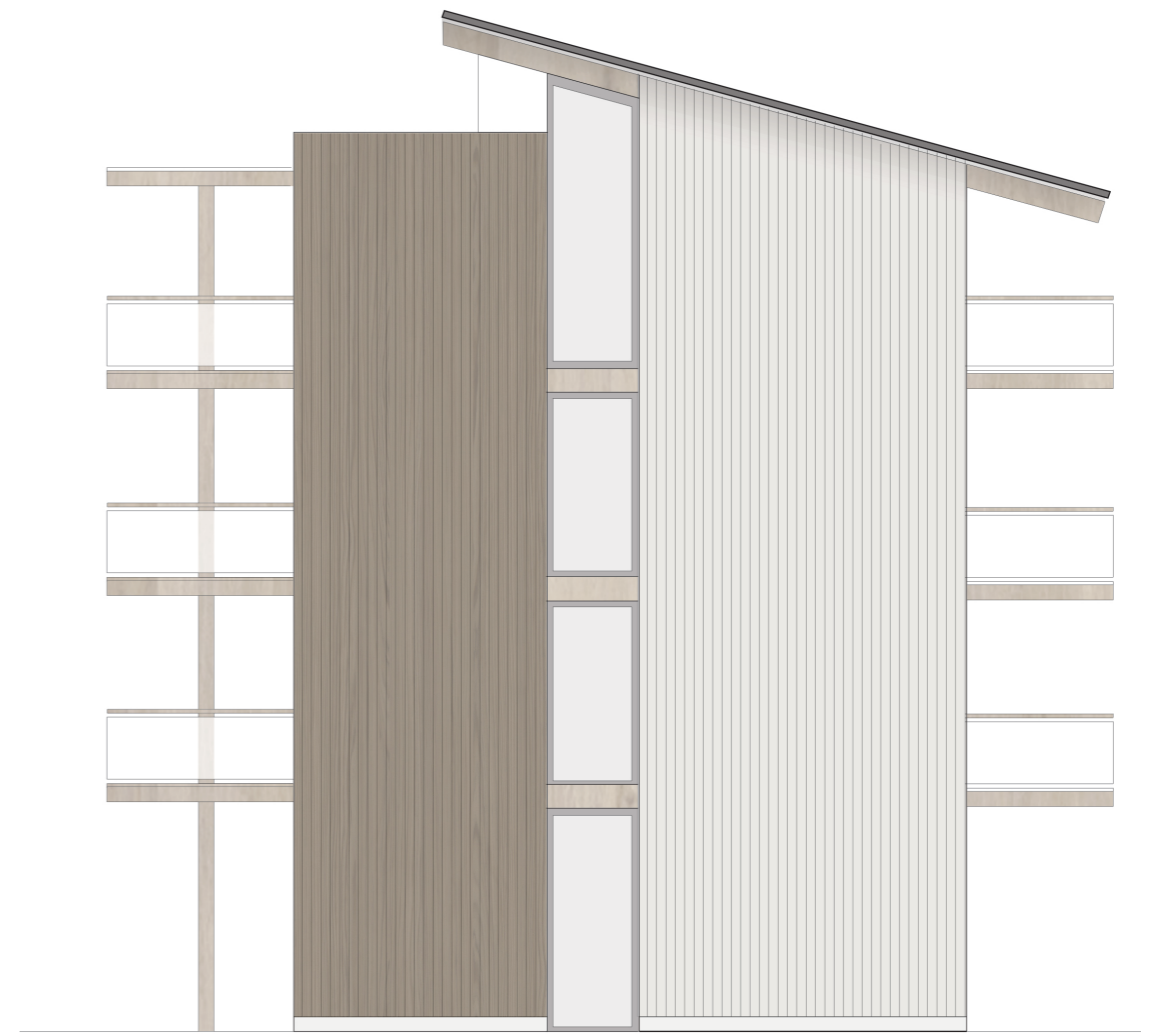




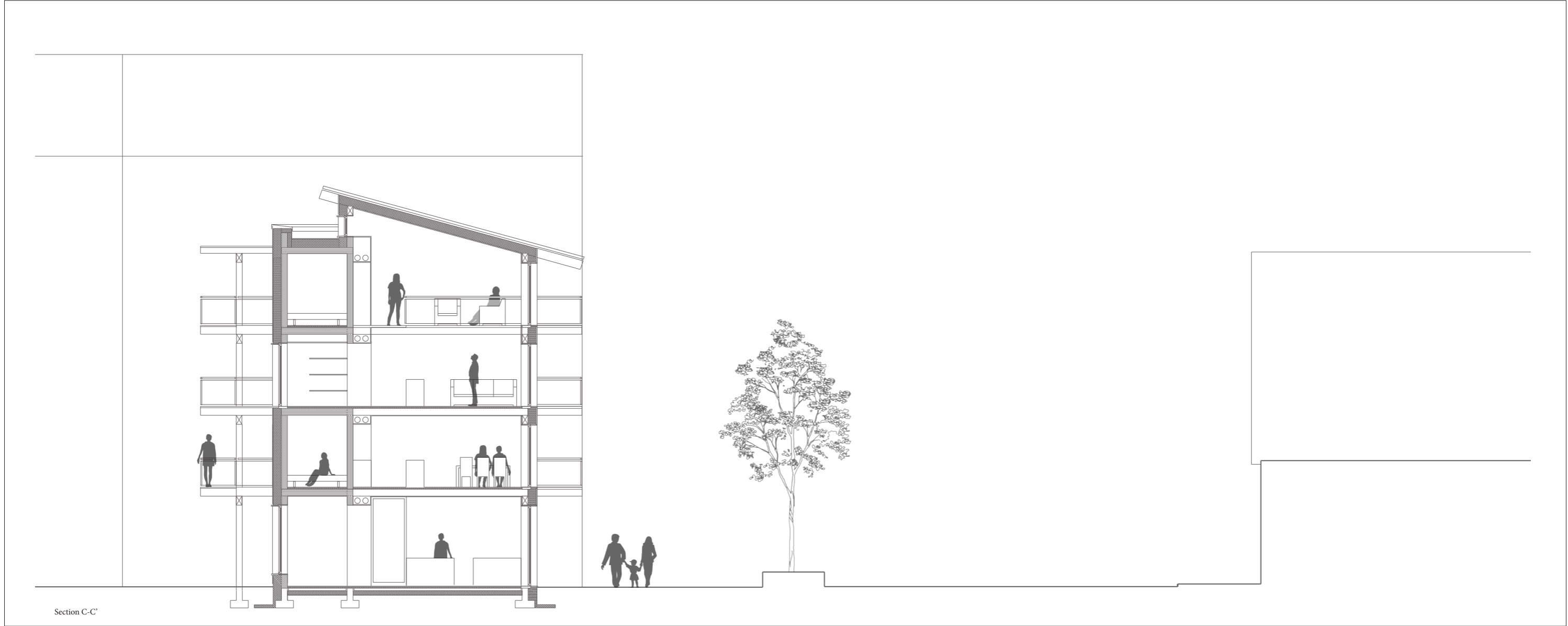
South facade



Section D-D'



West facade



Section C-C'

## REDUCING EMISSIONS

Several measures can be done to reduce a buildings emission. Firstly the emissions from the material of the building should be as low as possible. Secondly the building should be designed to have a low energy demand. To compensate for its emissions, the building can produce energy on site



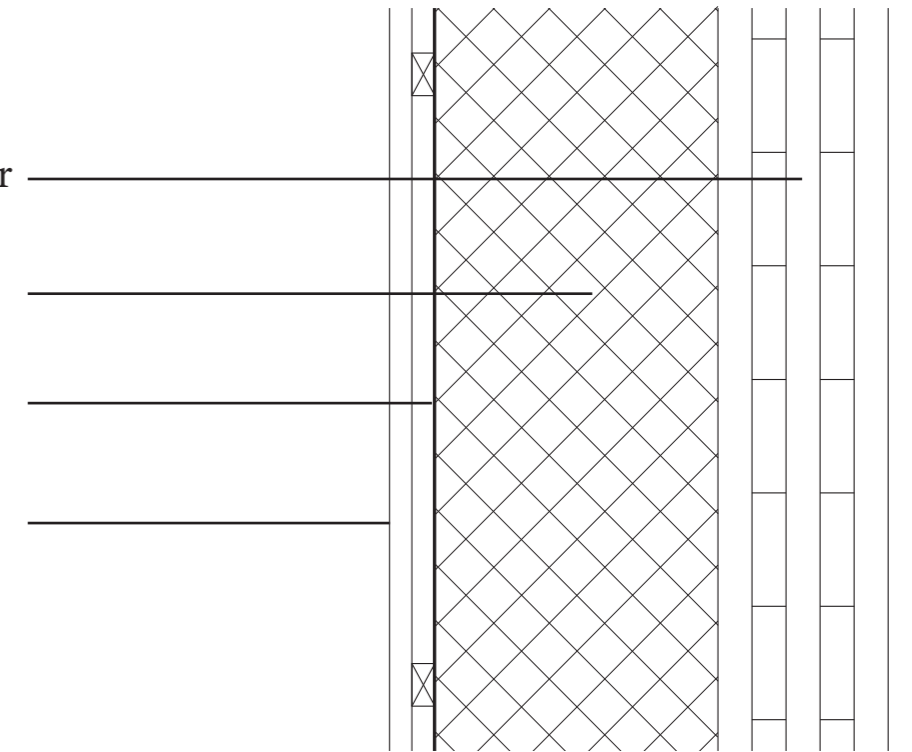
## ENVIRONMENTALLY FRIENDLY MATERIALS

Cross laminated timber

Wood fibre insulation

Sheating

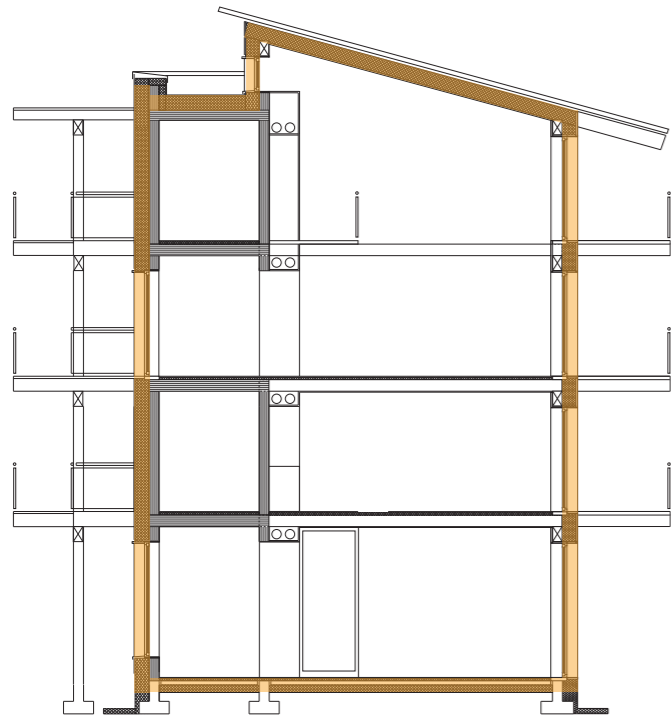
Wood panel



Structure, insulation and cladding in wood

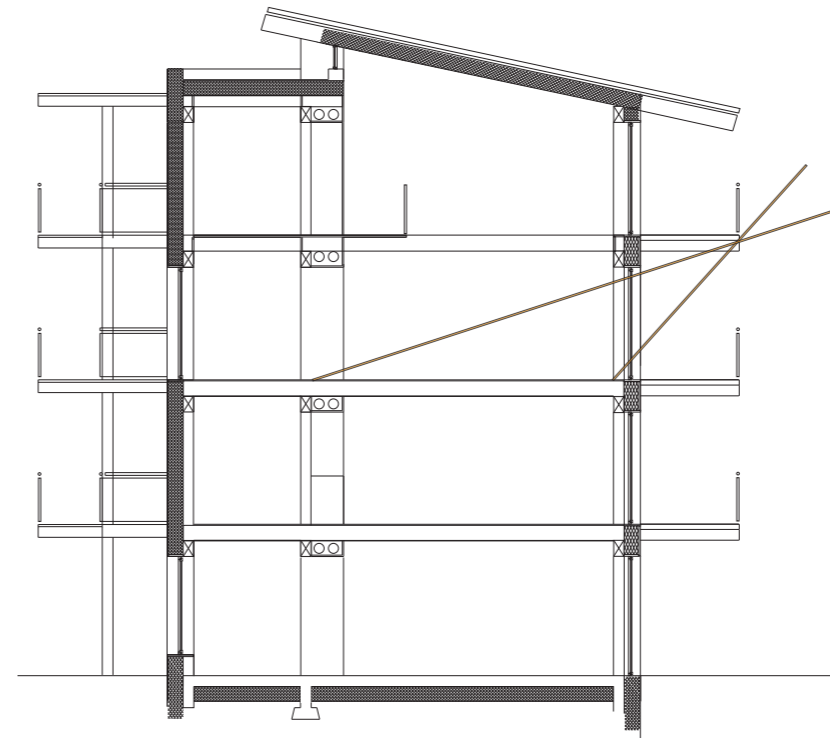
# PASSIVE STRATEGIES

## WINTER



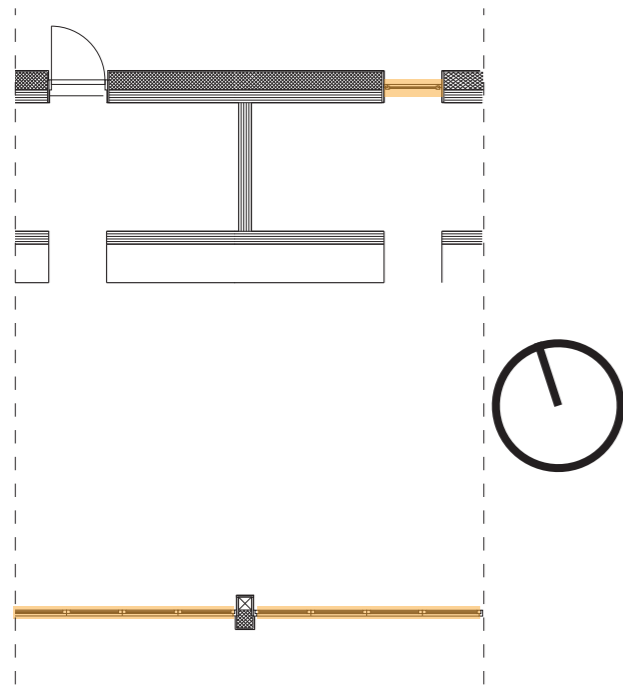
In Norway, heating is what requires the most energy when it comes to housing. To reduce the energy demand the walls are highly insulated, and the building has a compact form.

## SUMMER



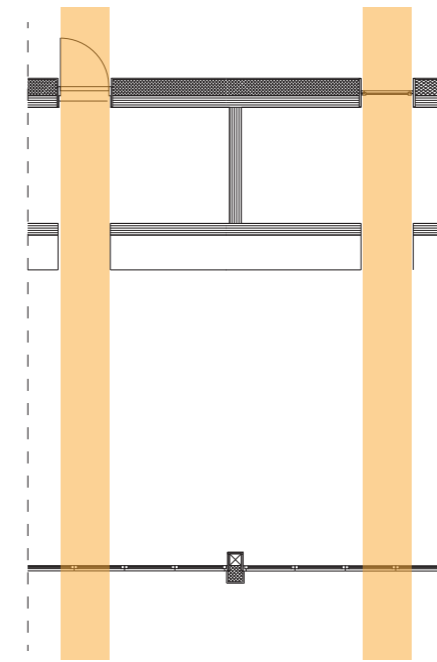
During summer you can have problems with overheating, especially when you have large window areas towards the south. To prevent the summer sun from entering the building the roof has an overhang. For the lower floors, the balconies protect from the summer sun.

Shutting out summer sun



The energy from the sun can be taken advantage of by having glazed areas towards the south. From the north you don't have the same heat gain, especially not during winter months when the need of heat is the biggest.

Glazed area towards south

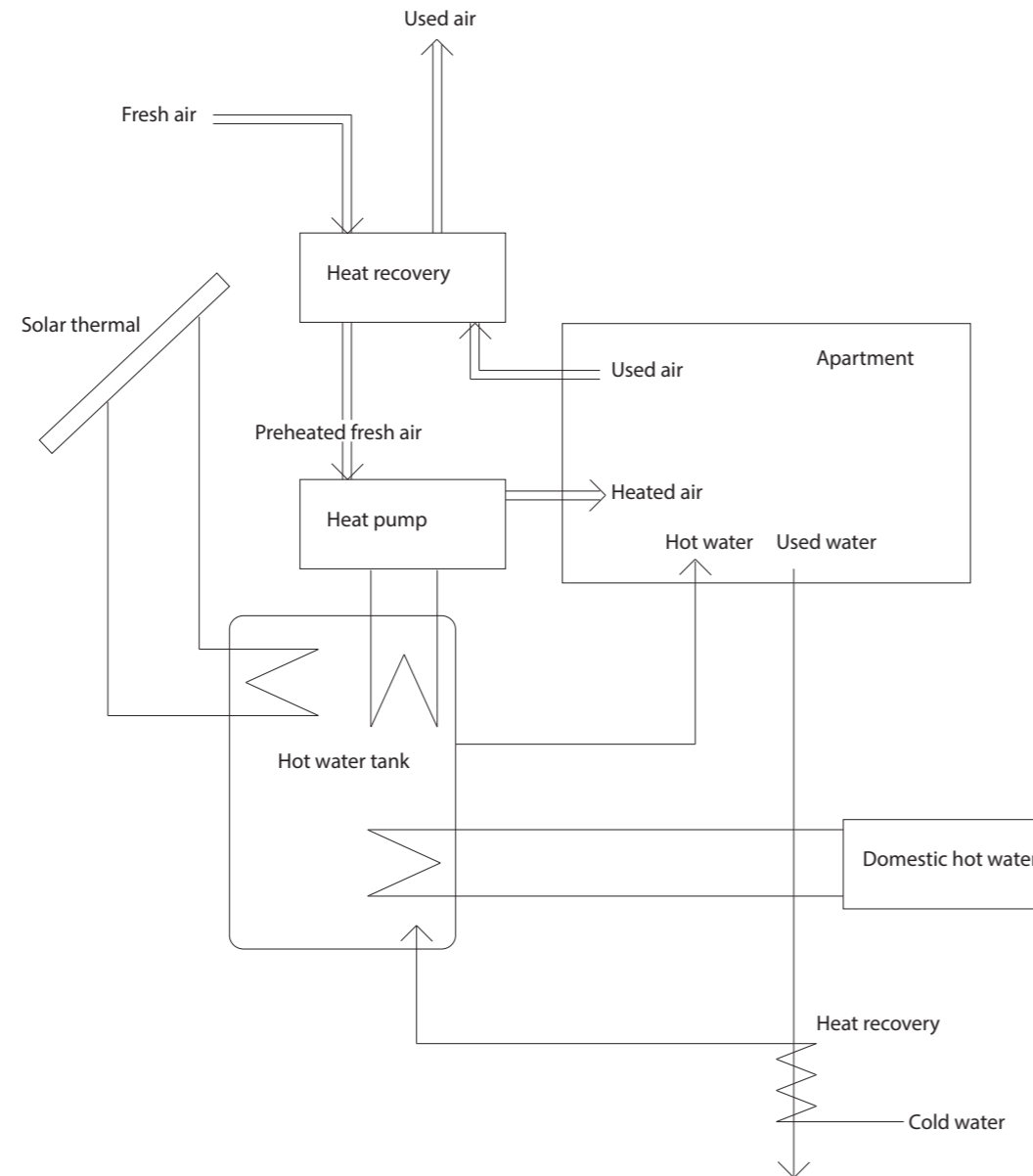


For additional comfort during warm summer days, there are openable windows on both side of the building. In this way the building can be cooled naturally through cross ventilation.

Cross ventilation

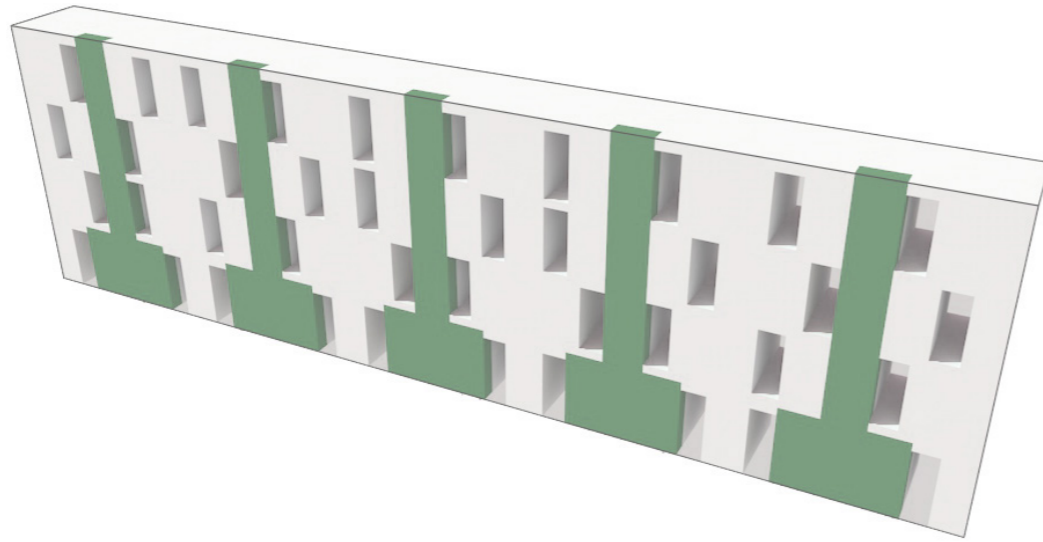
# ACTIVE STRATEGIES

## TECHNICAL SYSTEMS



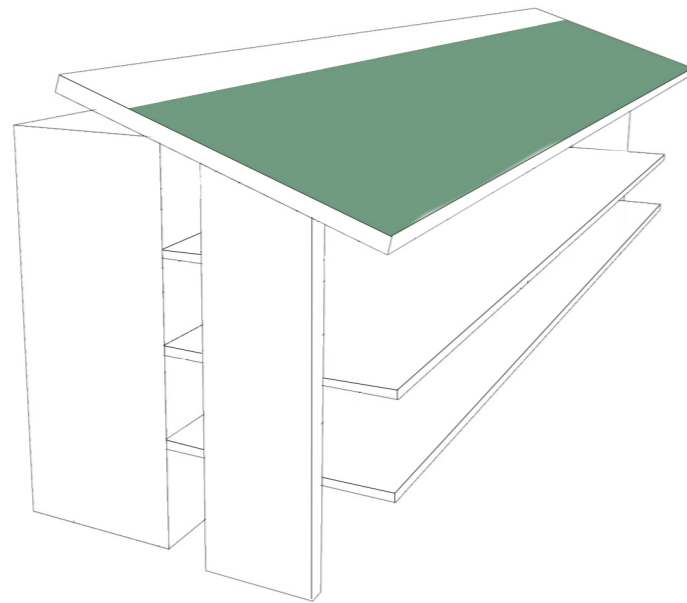
The system for heating water and air in the building. The water is heated both with the solar collectors and by district heating. The air is heated by water source heat pumps. In this way, the floors and walls can be free from pipes, and the quantity of metal is reduced. The building also becomes more flexible, making it easier to remove or add floors or walls.

## TECHNICAL CORES TO REDUCE PIPES

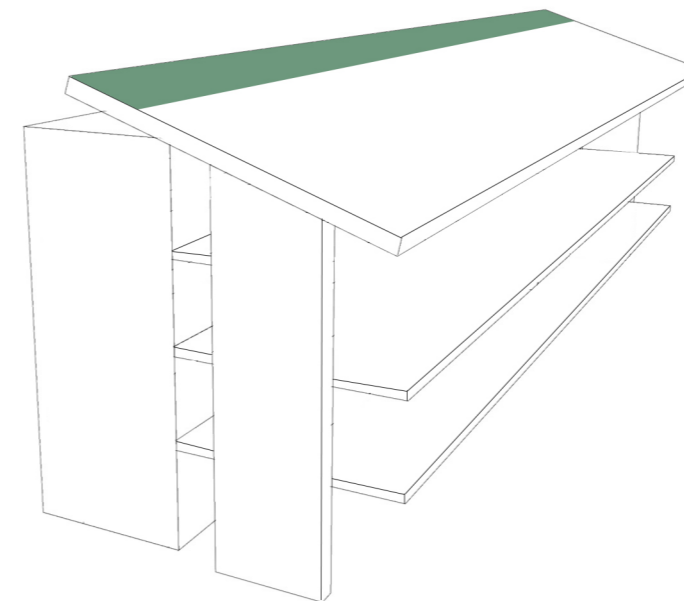


In Norway we can not reach the level of comfort we require with passive strategies alone. The technical equipment we have in our house are also responsible for CO<sub>2</sub> emissions. For this reason the technical equipment is shared by several apartments, and is restricted to a core in the massive part of the building.

## PRODUCING ENERGY

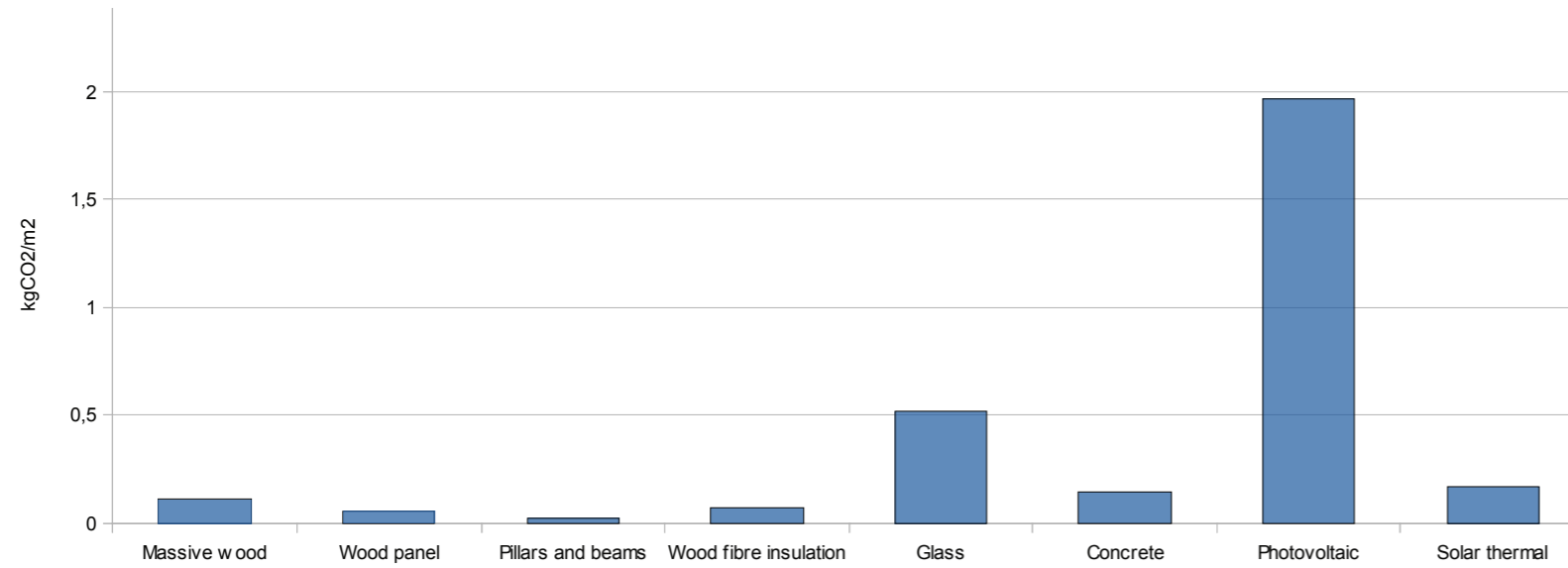


To produce energy for the building, the roof is covered with 360m<sup>2</sup> of photovoltaic panels. The roof is south oriented and has an angle of 15°.

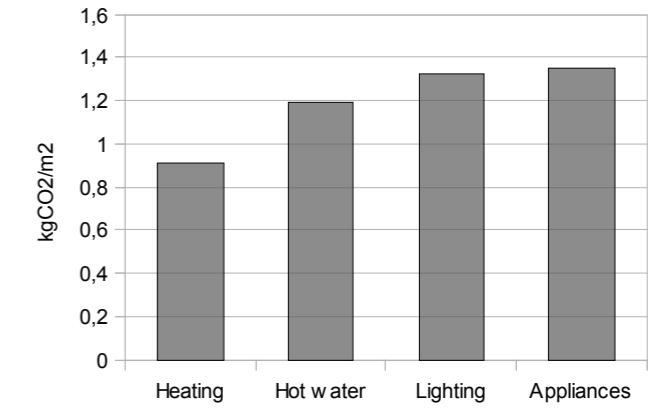


To produce hot water the roof is covered with 45m<sup>2</sup> of solar collectors

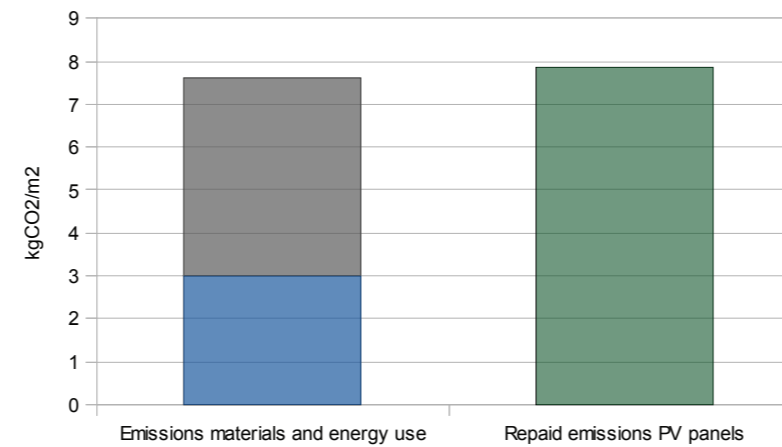
# EMISSION BALANCE



The emissions from the material of the house. The PV-panels are responsible for the biggest amount of emissions. However, this is justified by the energy they produce.



The passive strategies reduces the heating demand, and eliminates the cooling demand. The hot water is reduced by 50% because of the solar collectors. For lighting and appliances the most energy efficient devices are considered.



The emissions from the materials and the use of the building can be repaid by the electricity produced from the PV-panels. However, only the main categories of materials are considered. Also the emissions from appliances are not considered. If everything was taken into the calculation, the energy production would not be sufficient.





