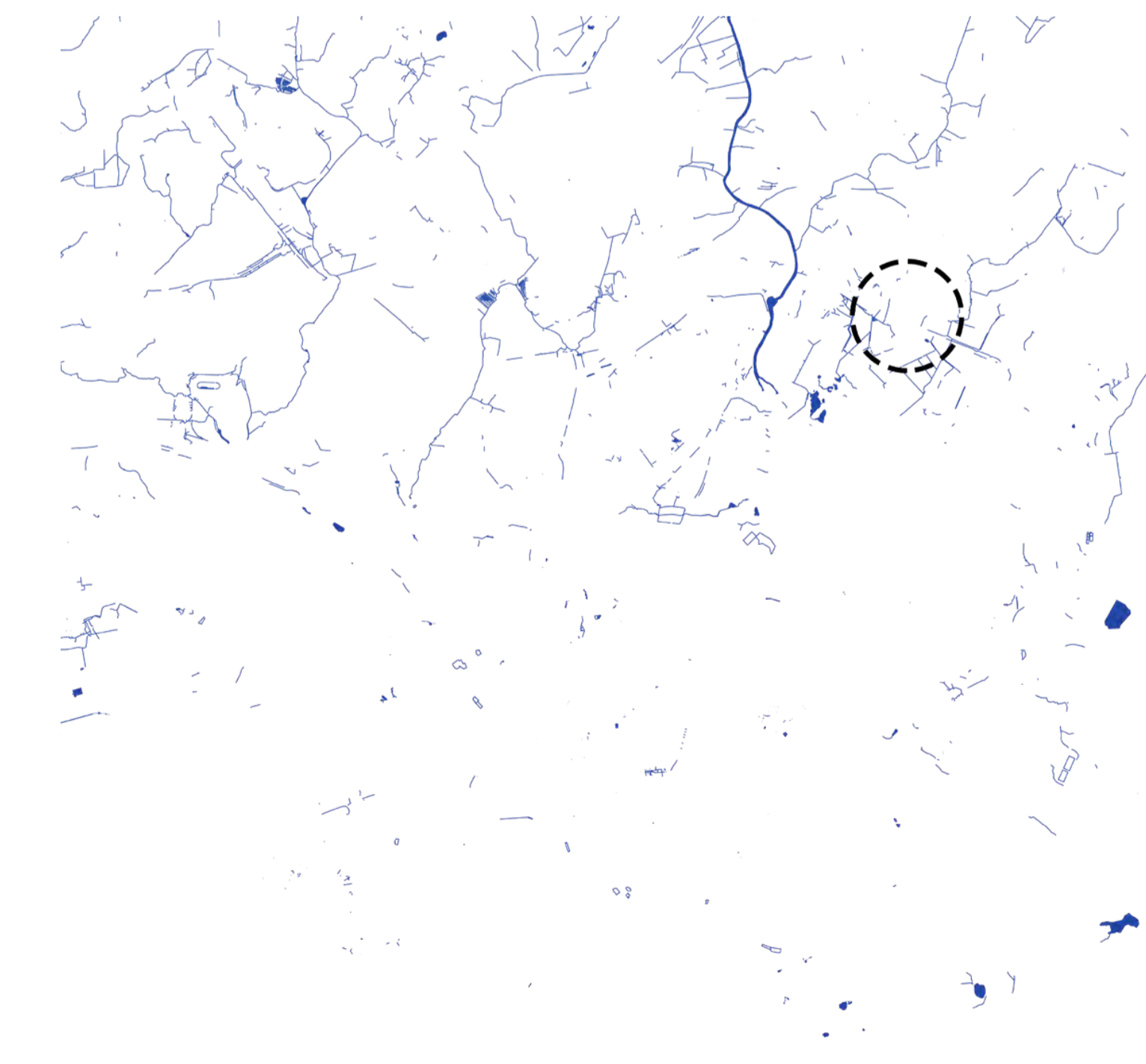
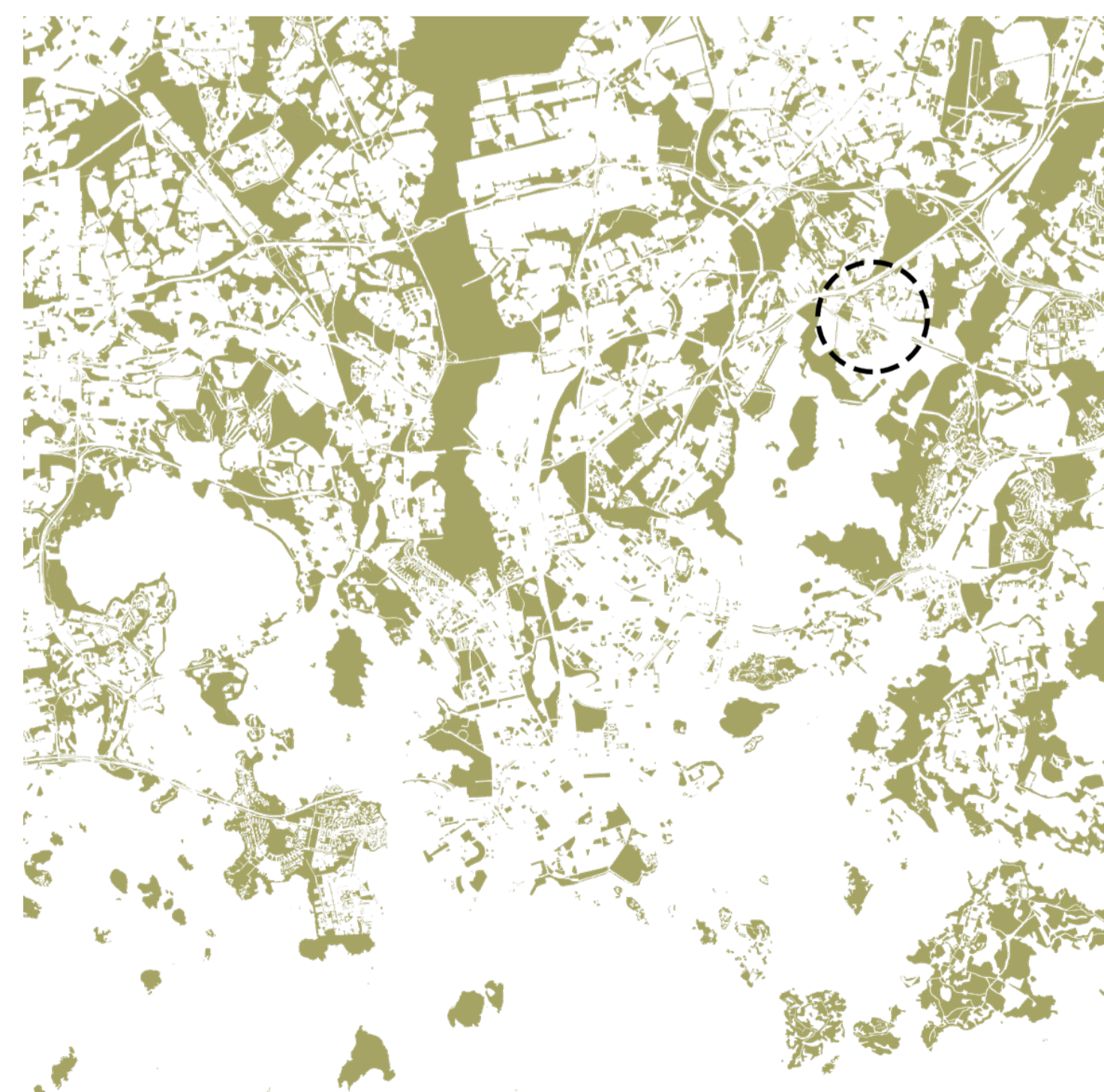


RURBAN HABITAT

RESEARCH
REDUCE
REUSE
PRODUCE
INTEGRATE



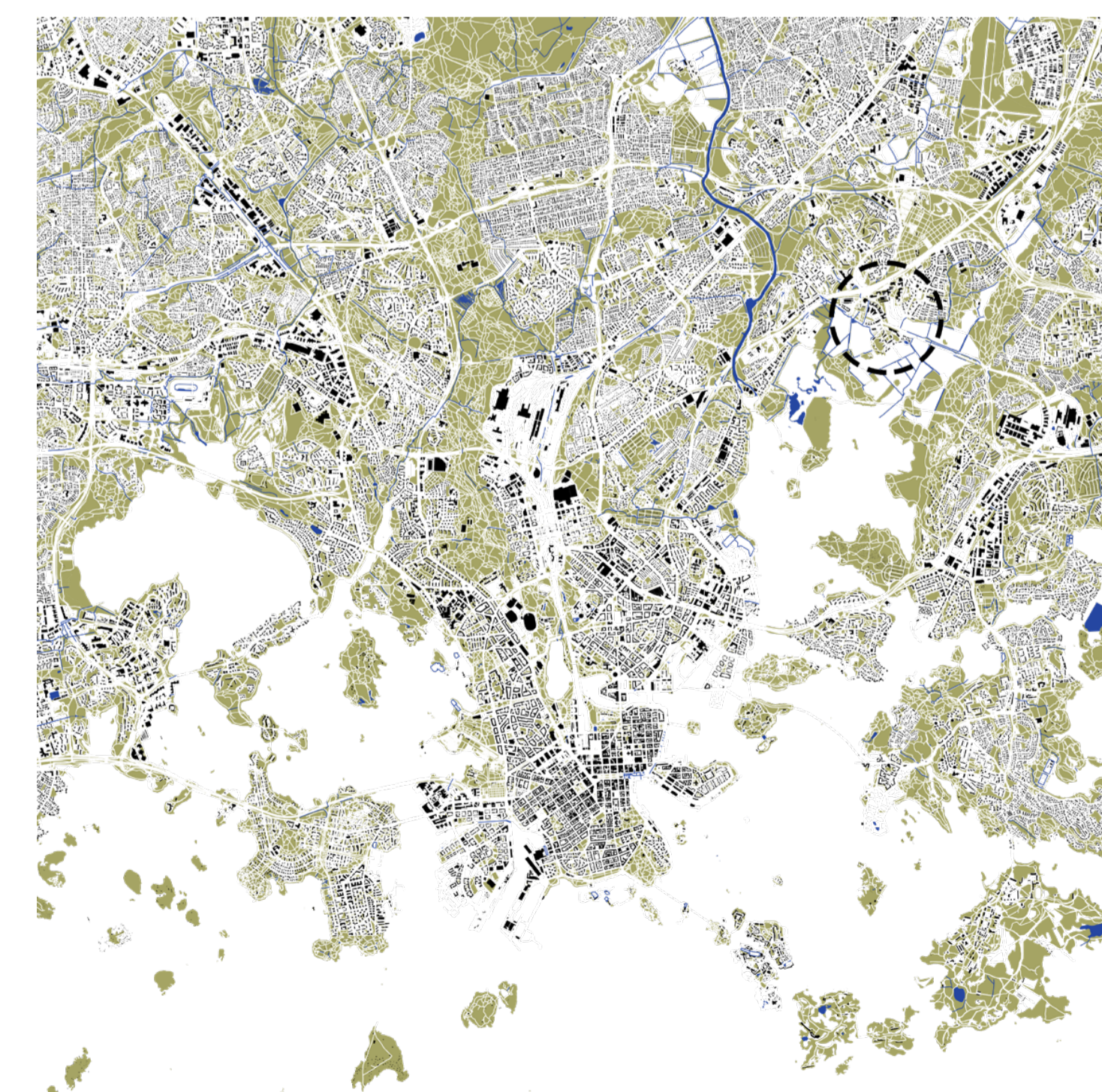
water layer



greenery layer (49%)



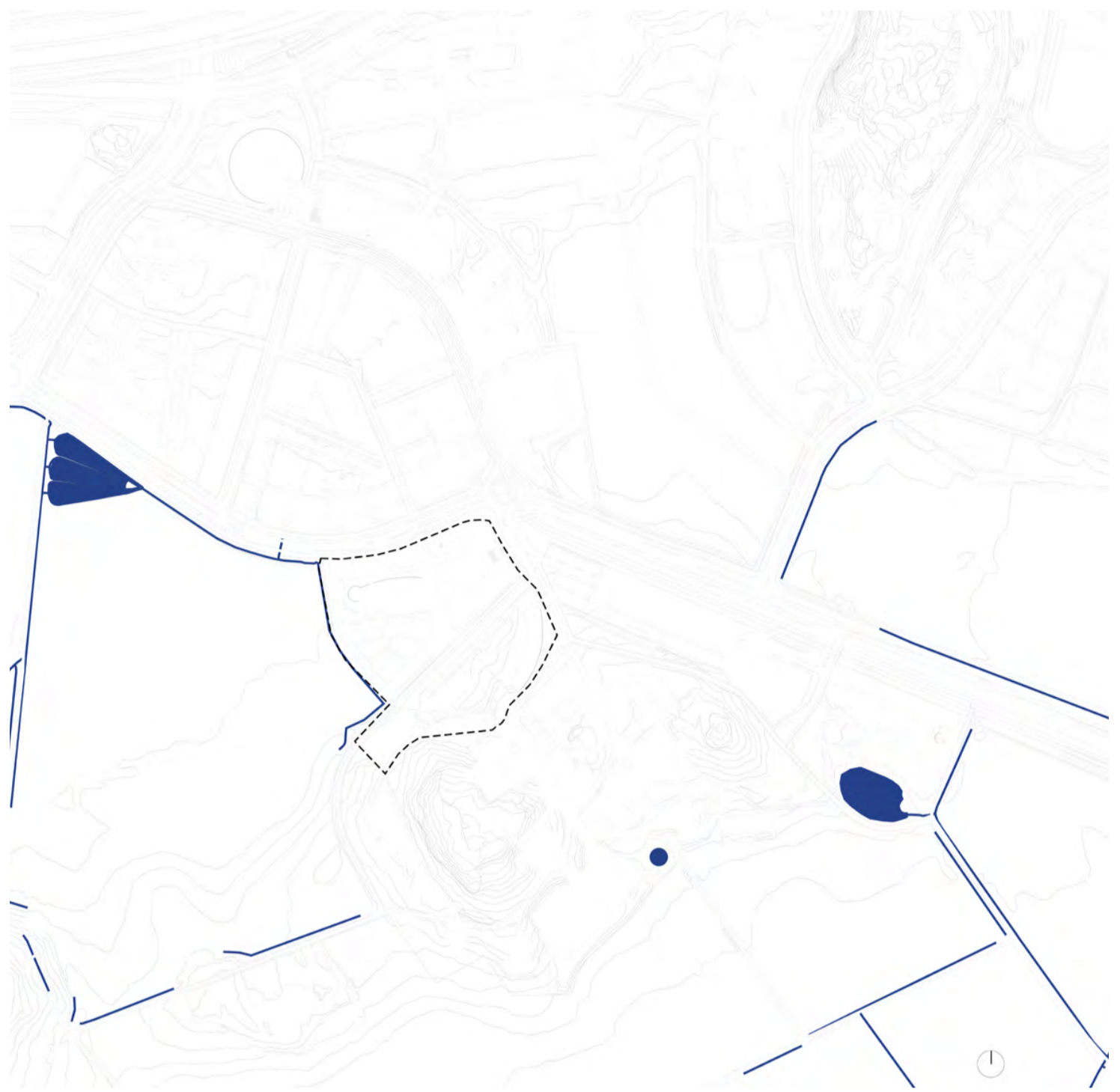
urban layer (51%)



Helsinki landscape

“Landscape is a shared renewable good at the heart of the ecological transition.”

~ Nicolas Hulot (the French journalist, ecologist, and politician); engages in debates regarding the ecological challenges of the modern world



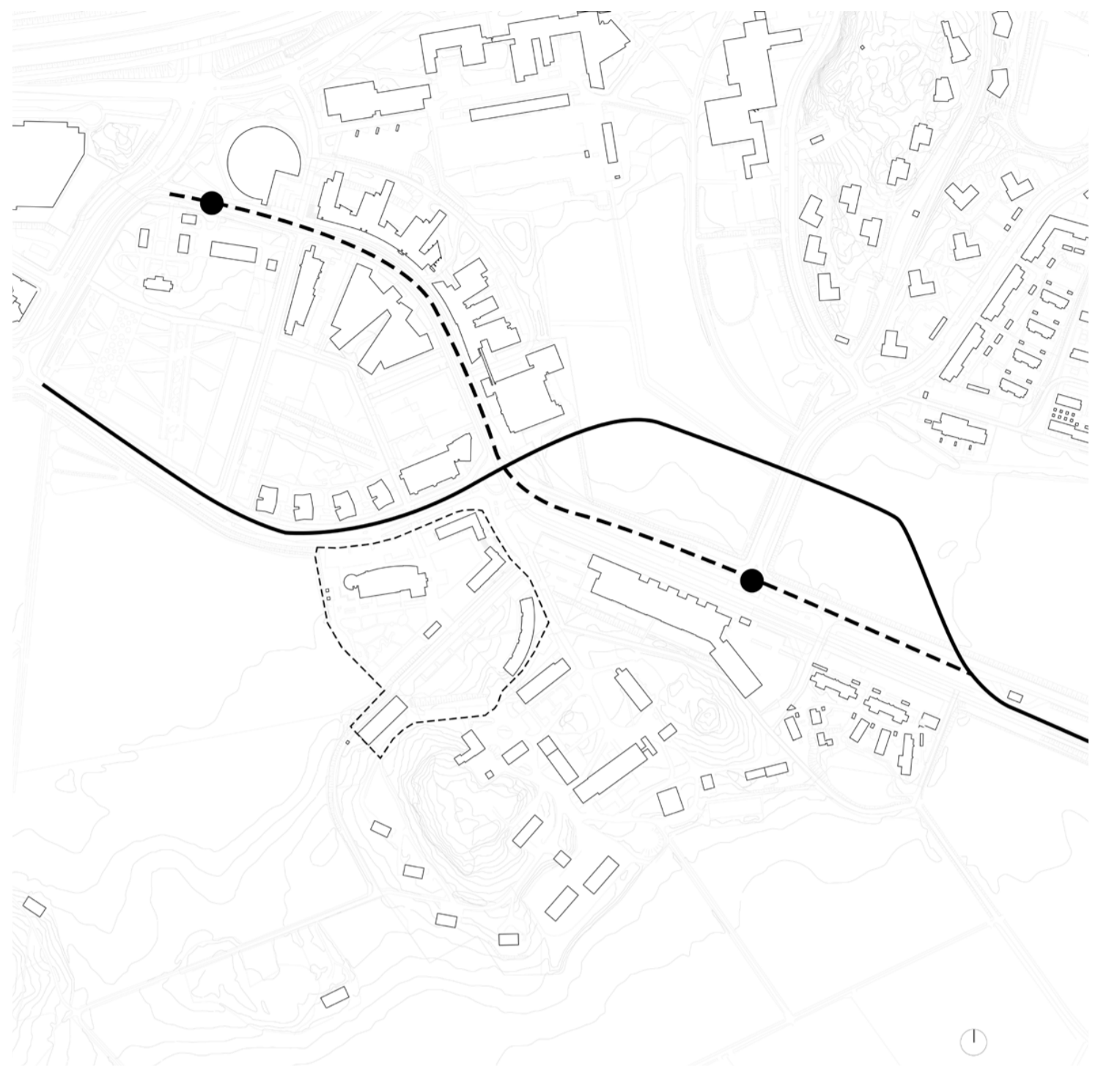
water layer



greenery and agriculture fields layer



existing and new pedestrian and bicycle connections



change of car transport, new tram line

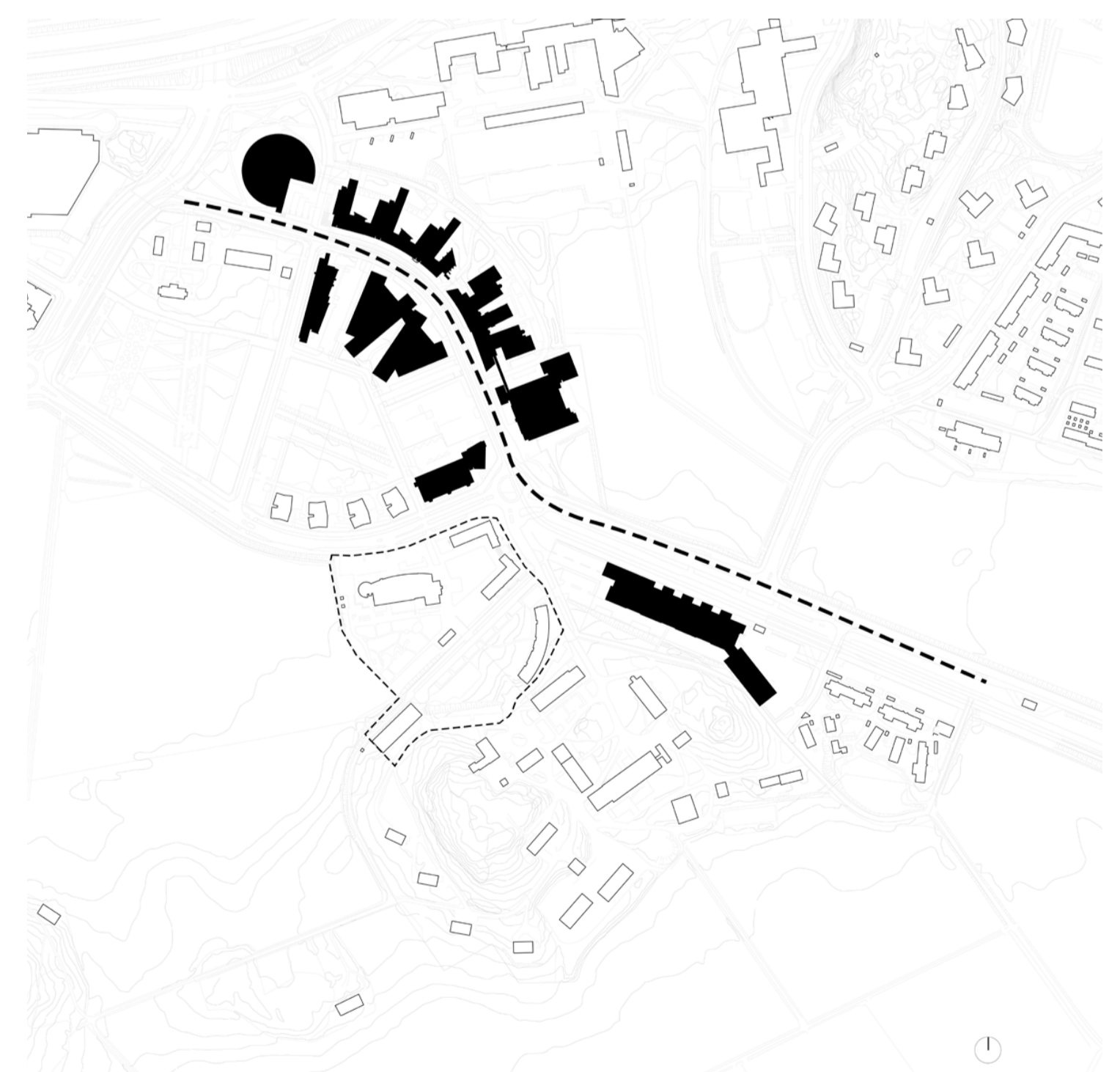
rural



urban



historic rural tissue



Viikki's core - Univeristy campus



Viikki's scattered tissue



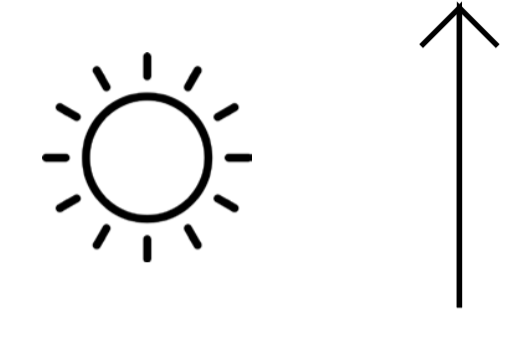
Viikki's landscape

“Because we don't think about future generations, they will never forget us.”

~ Henrik Tikkanen (Finnish-Swedish author); perfectly captures the mindset of balance when discussing war and the significance of conflicts for future generations

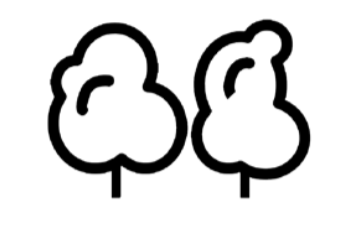
RESEARCH
REDUCE
REUSE

orientation towards the sun



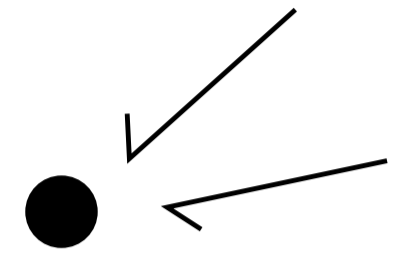
daylight
passive heating
reduced energy demand for heating and use of electricity

adaptation to the existing tree's layout



natural acoustic buffer
visual comfort of occupants
a place to live for all organisms

preserve the existing key views

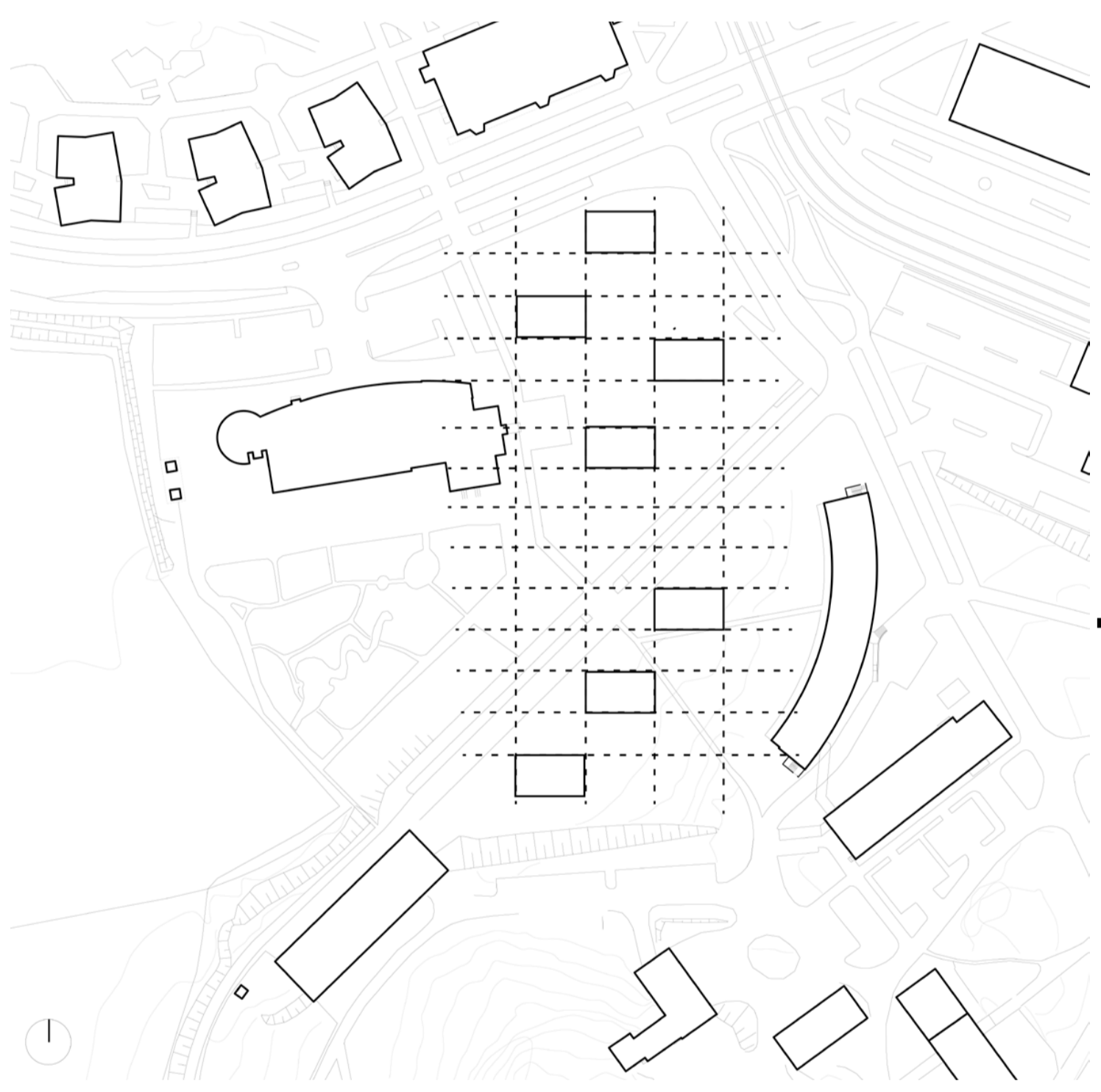


highlighting the architectural value of existing buildings
increasing acoustic comfort - withdraw from outdoor noise (road, railway)

sustainable habitat



urban space open to the natural landscape
utilizing passive and vernacular solutions to create sustainable architecture



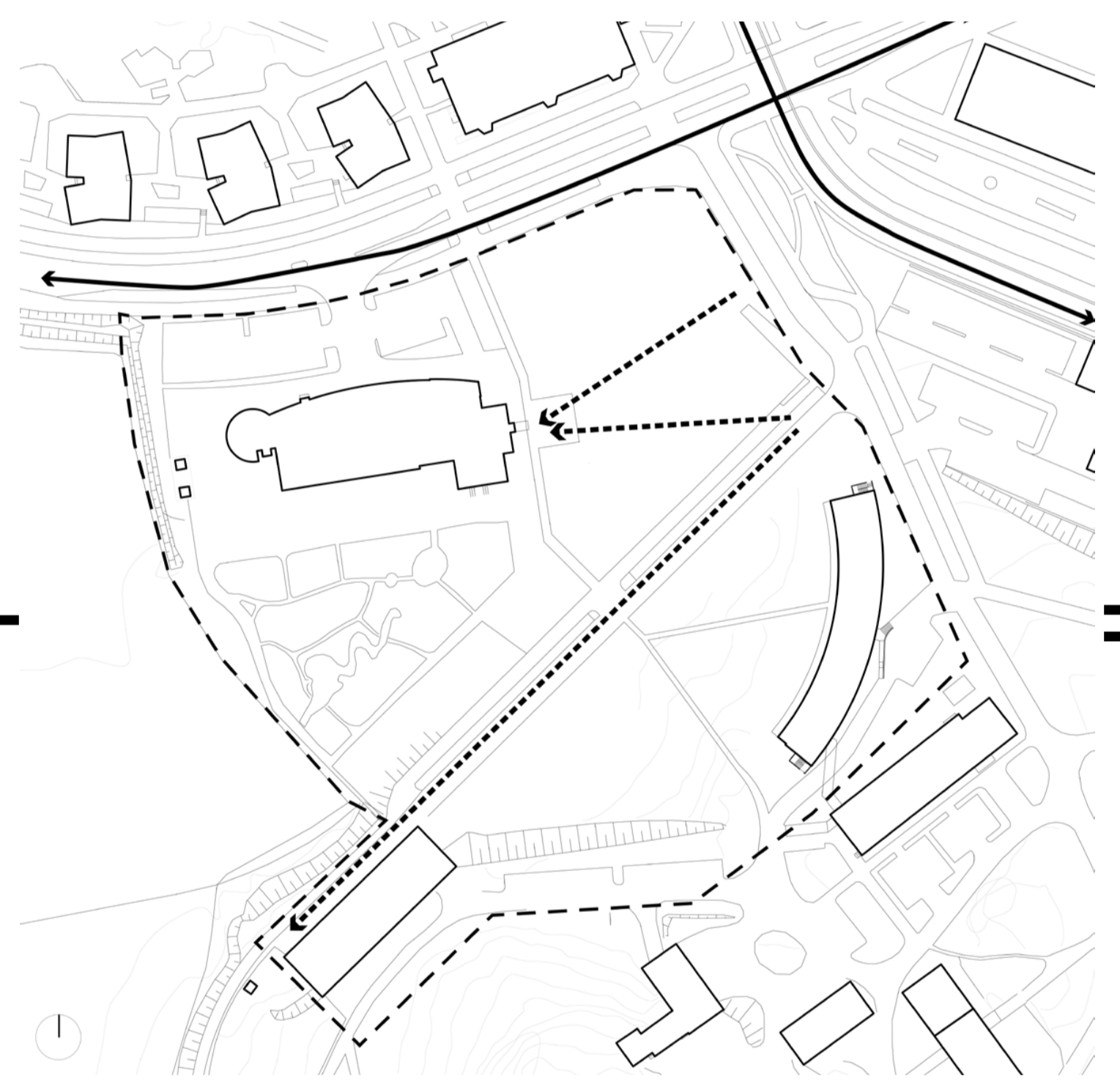
modular core house urban structure guided by sunpath
ensuring maximum daylight and passive heating

+



existing trees layout
115 saved trees

+



important visual and compositional axes

=



urban habitat friendly to nature and its inhabitants

rural



urban



urban

Core house A

Levels : 6
Dwellings : 3x 2 - bedroom
3x 3 - bedroom
498,0 m²
Services:
- Two story restaurant with a grocery : 332,0 m²

Core house B

Levels : 6
Dwellings : 6x 2 - bedroom
405,0 m²
Services:
- Pet store
- Animal hair salon. : 270,0 m²

Core house E

Levels : 4
Dwellings : 8x 2 - bedroom
540,0 m²
Services:
- Cafe and booksharing : 135,0 m²

Core house H

Levels : 2
Coliving rooms : 23 x 2 - bedroom
12 x 1 - bedroom
4 x 2 - bedroom for people with disabilities
965,5 m²
Services:
- Fabrication Laboratory : 1285,5 m²

Sauna

BUILDING A

Community Gardens

Pavillion

Local Grocery Shop : 75,0m²

Auditorium

Fabrication Laboratory

Pavillion

Artisan Bakery : 75,0m²

Water Zone

Dog Park

Event Zone

Playground

Pavillion

Custom Bike Center : 75,0m²

Core House F

Levels : 4
Dwellings : 4x 2 - bedroom
4x 3 - bedroom
664,0 m²

Core House C

Levels : 5
Dwellings : 8x 2 - bedroom
540,0 m²
Services:
- Coworking : 135,0 m²

GARDENIA

Core House D

Levels : 5
Dwellings : 4x 2 - bedroom
4x 3 - bedroom
664,0 m²
Services:
- Yoga studio : 166,0 m²

Court

Core House G

Levels : 4
Dwellings : 8x 2 - bedroom
540,0 m²

Carsharing spot with charging stations

Sport and Recreational Path

Woonerf

JAPANESE GARDEN

Jump spot

OLD MUSEUM
Multifunctional court



RESEARCH

Inhabitants:

-  young families
-  permanent and temporary researchers
-  students
-  people with special needs
-  pets
-  farm animals
-  birds
-  and many other organisms

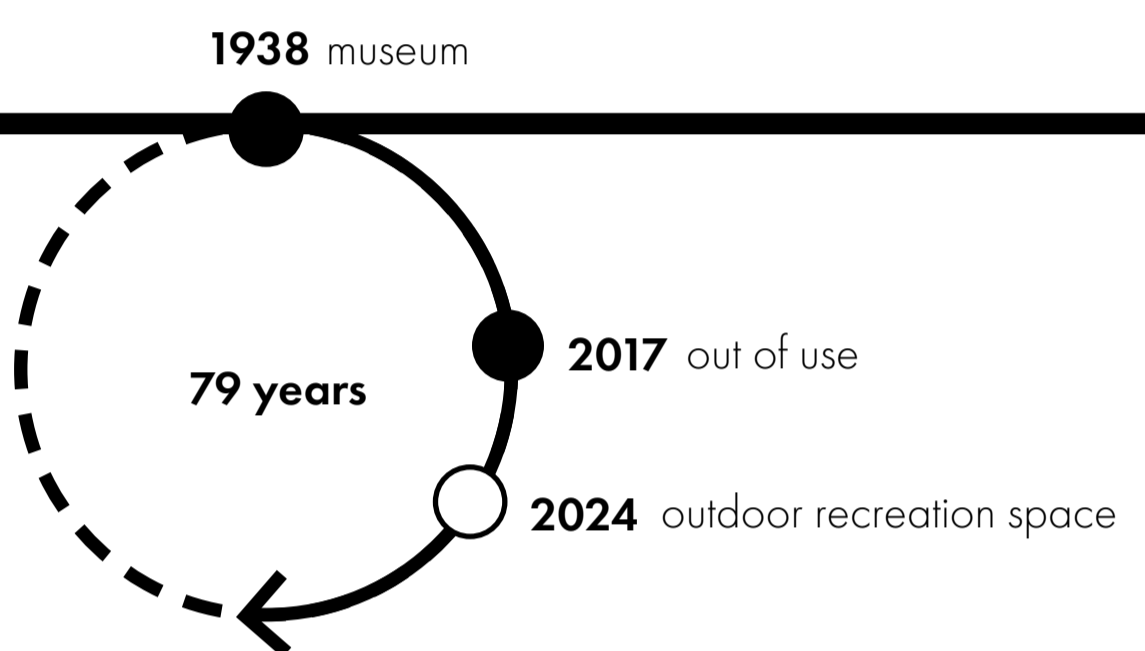
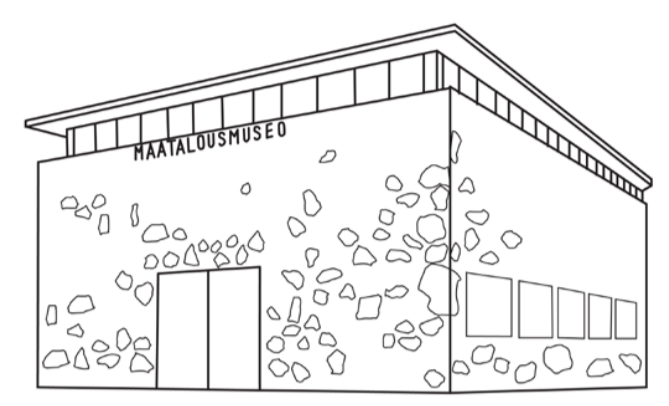
Elements integrating the Finnish community:

-  love and respect for the natural environment (*jokaisenoikeudet* - everyman's right)
-  sauna
-  Finnish libraries
-  sport - especially winter sports
-  hiking (*allemansrätten* - freedom to roam)
-  cycling

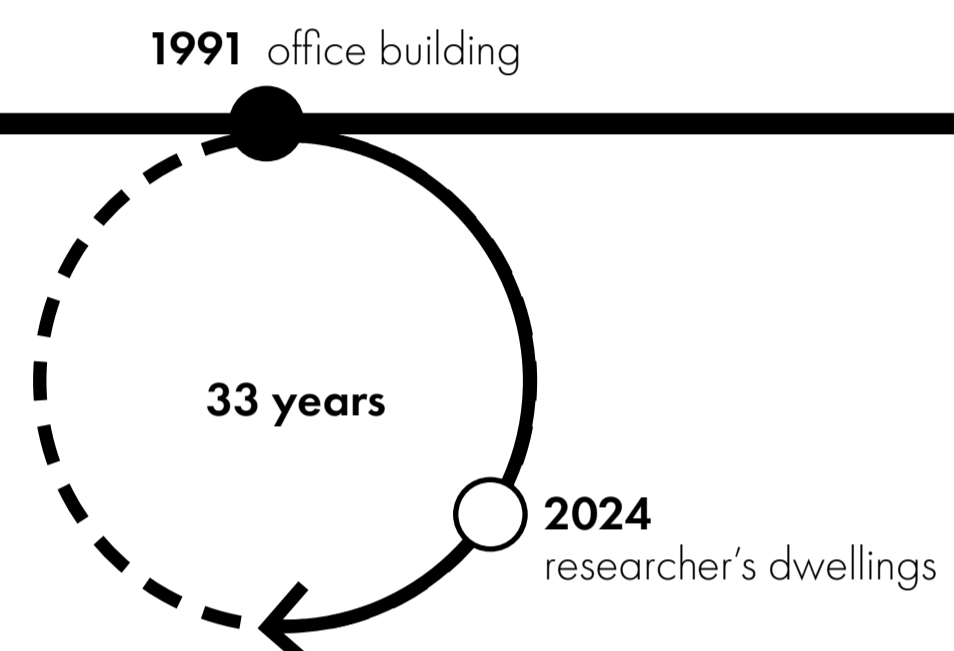
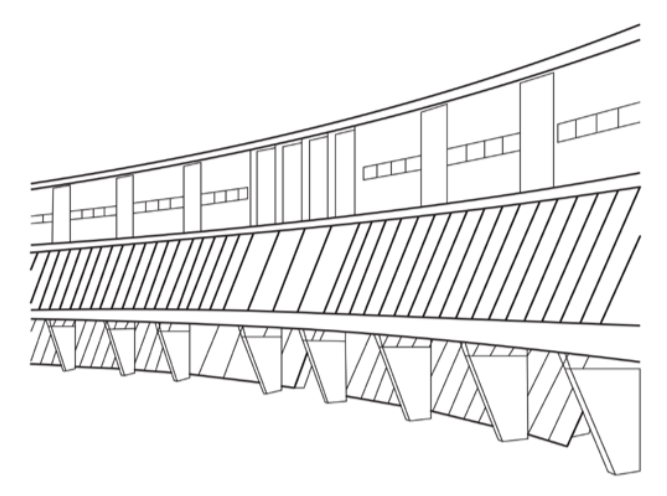


RESEARCH
 REDUCE
 REUSE
 PRODUCE

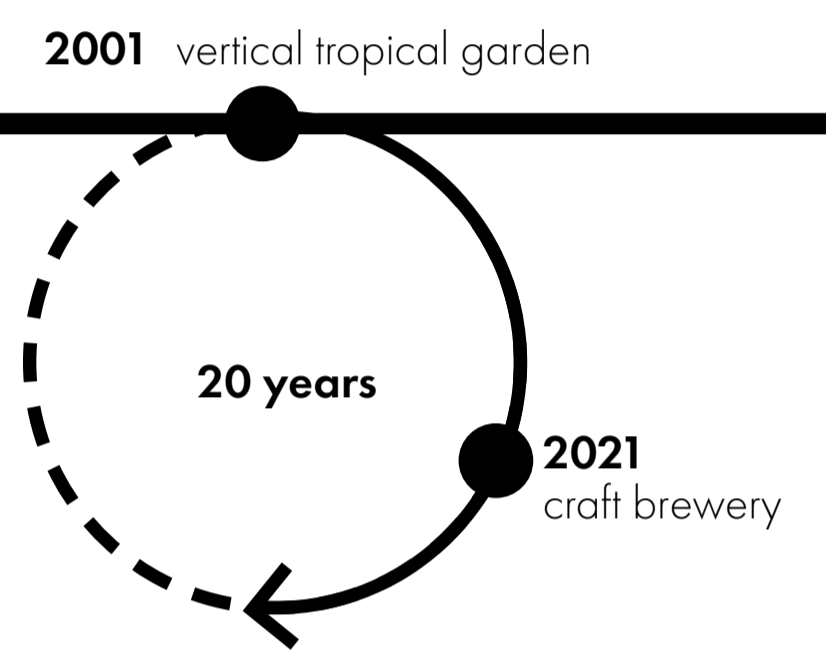
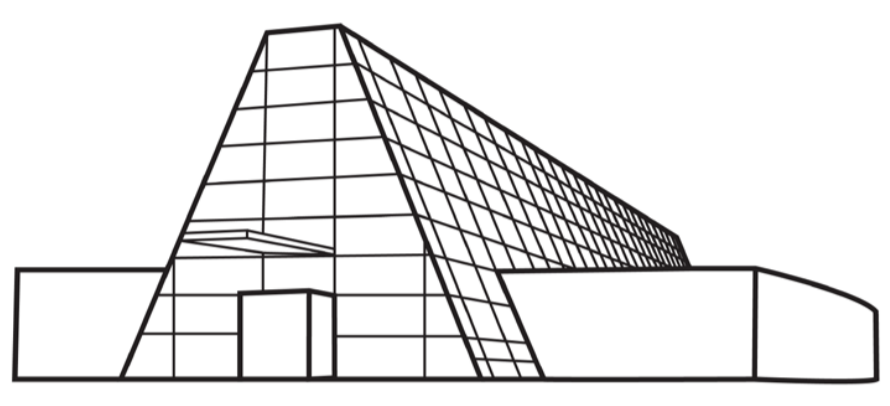
Agriculture Museum (Maatalousmuseon)



Administration facility of the Helsinki University



Gardenia



PRODUCE
 pv panels roof integration enabling electricity production from renewable energy source

REDUCE
 maximize daylight in buildings and allows for passive heating

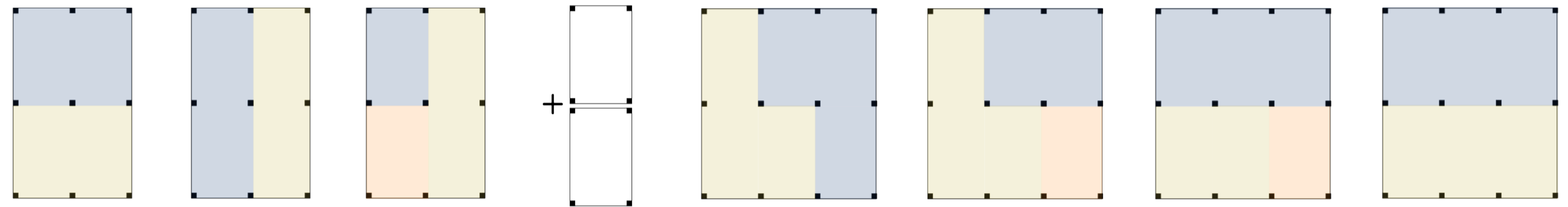
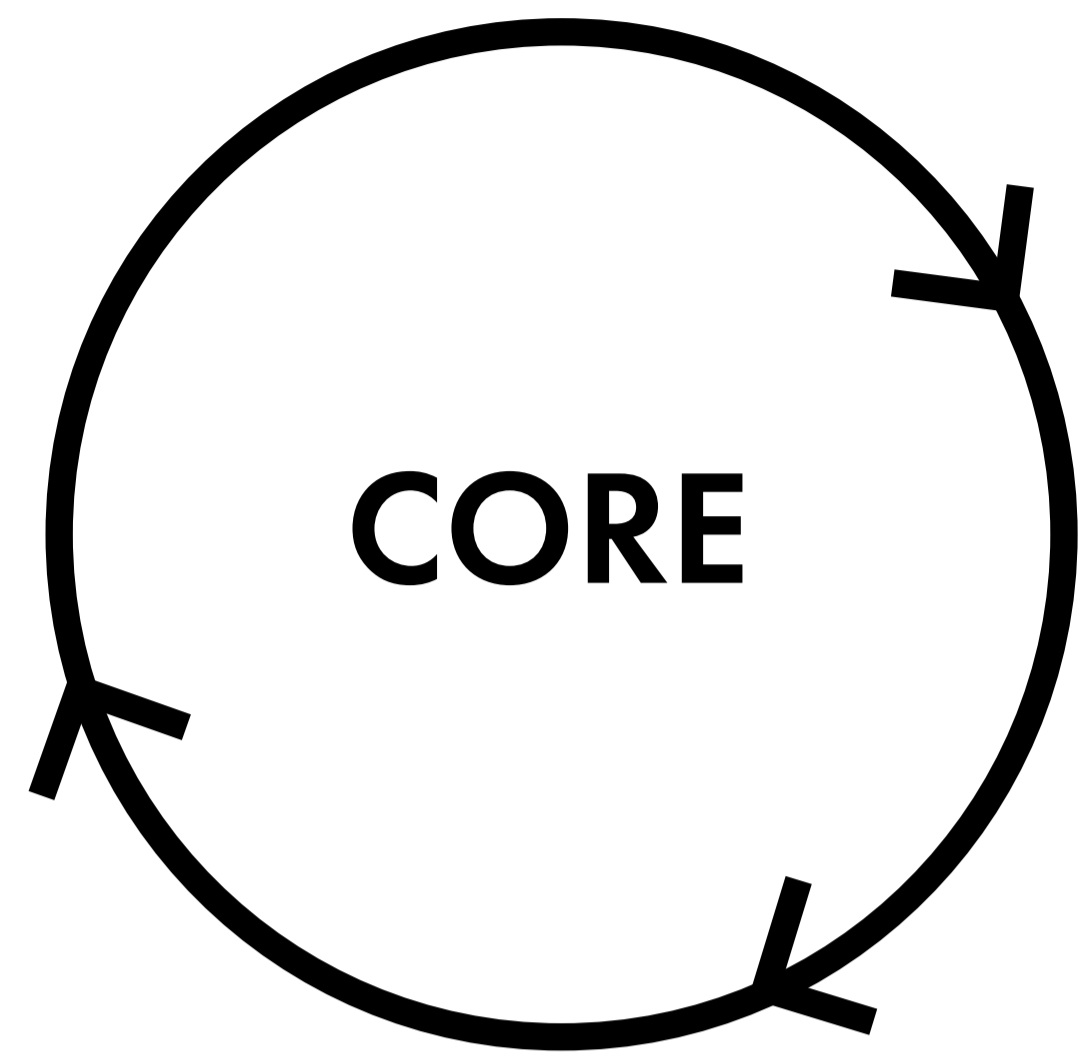
RESEARCH
 preserving and increasing biodiversity care for the existing context

REUSE
 readapting the walls of the old museum into a sports and recreational space; we removed all the windows to allow natural ventilation, strengthened the original wooden structure and covered it with a semi-transparent membrane that protects from snow and rain while allowing natural daylight



cross-section of the museum with elevations of the new buildings, 1:200





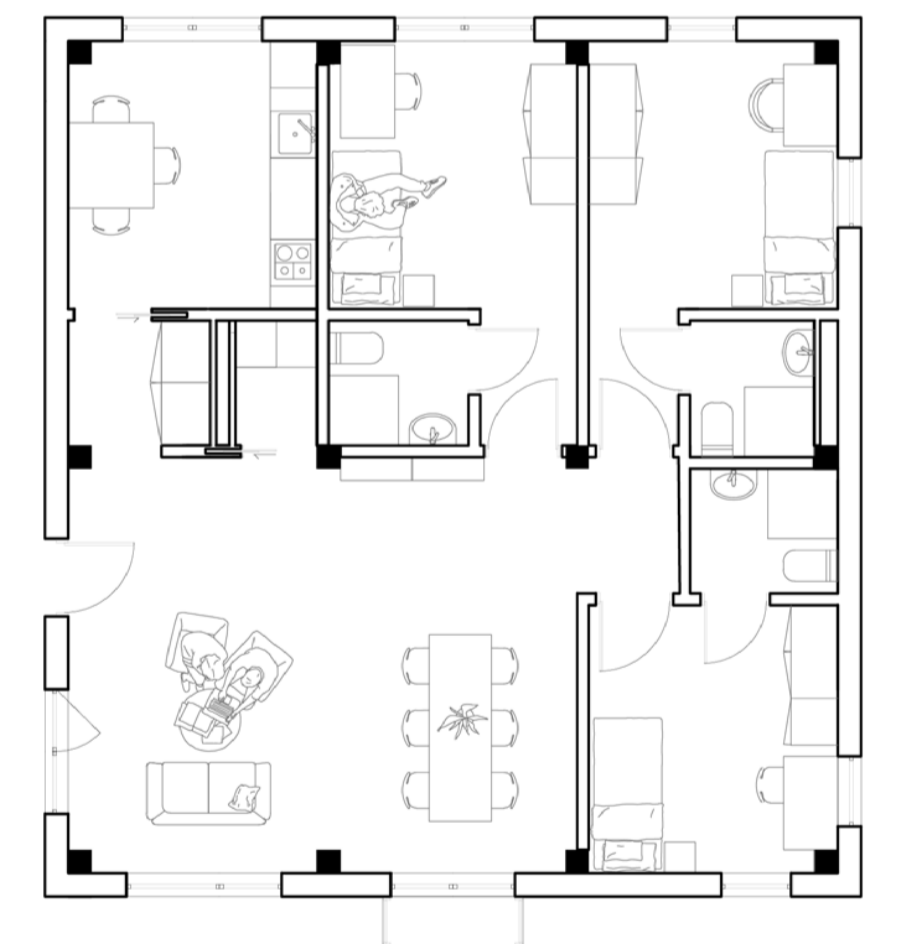
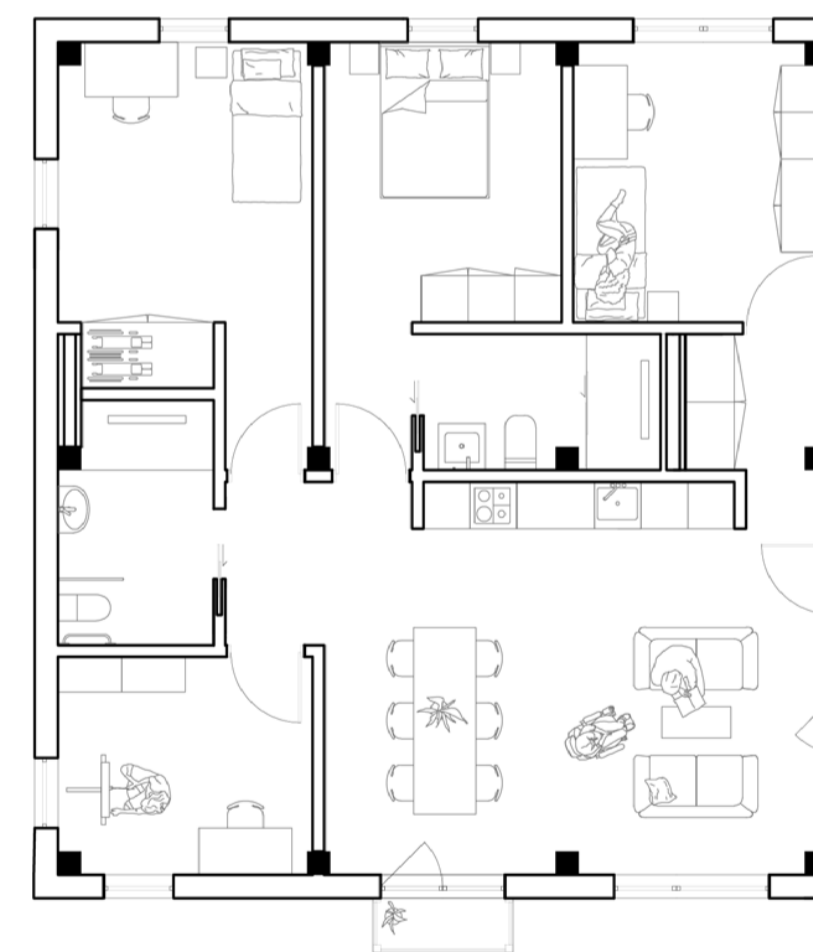
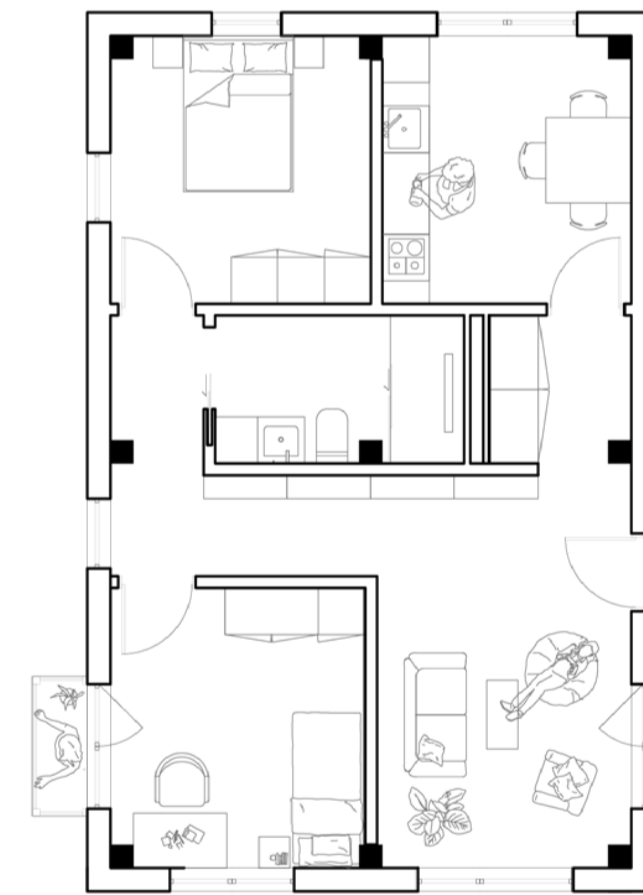
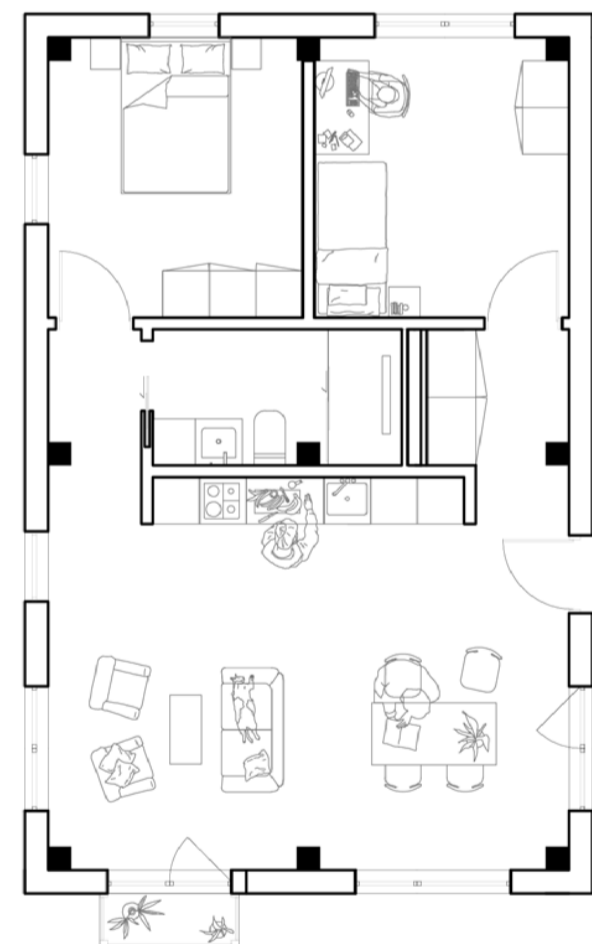
scenarios of changes in layouts by residents

CORE - 2 BEDROOM
(with kitchenette)

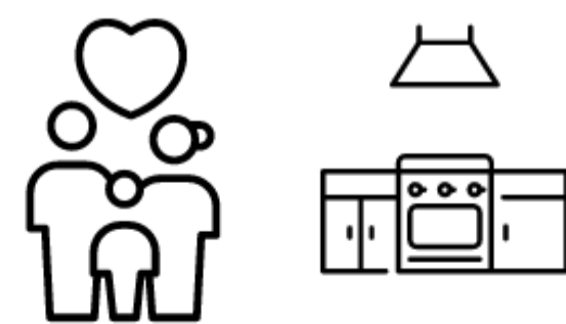
2 BEDROOM
(with separate kitchen)

EXTENSION - 3 BEDROOM
(adapted for people with disabilities)
(with extra workspace)

EXTENSION - 3 BEDROOM
(adaptation to coliving/hostel/dormitory)



CORE MODULE
2B2P*/2B3P



CORE MODULE - adaptation
2B2P/2B3P



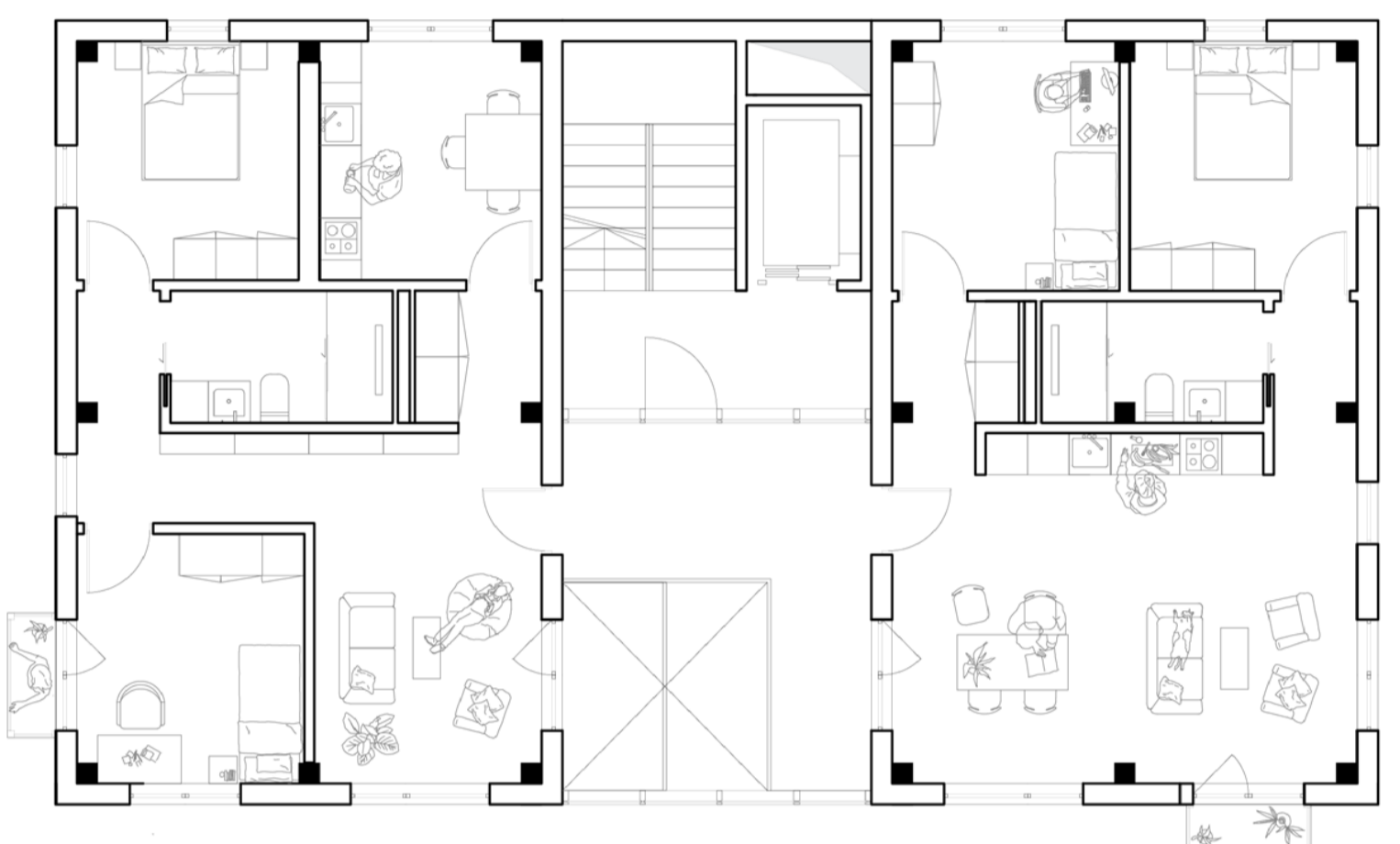
MODULE EXTENSION
3B3P/3B4P



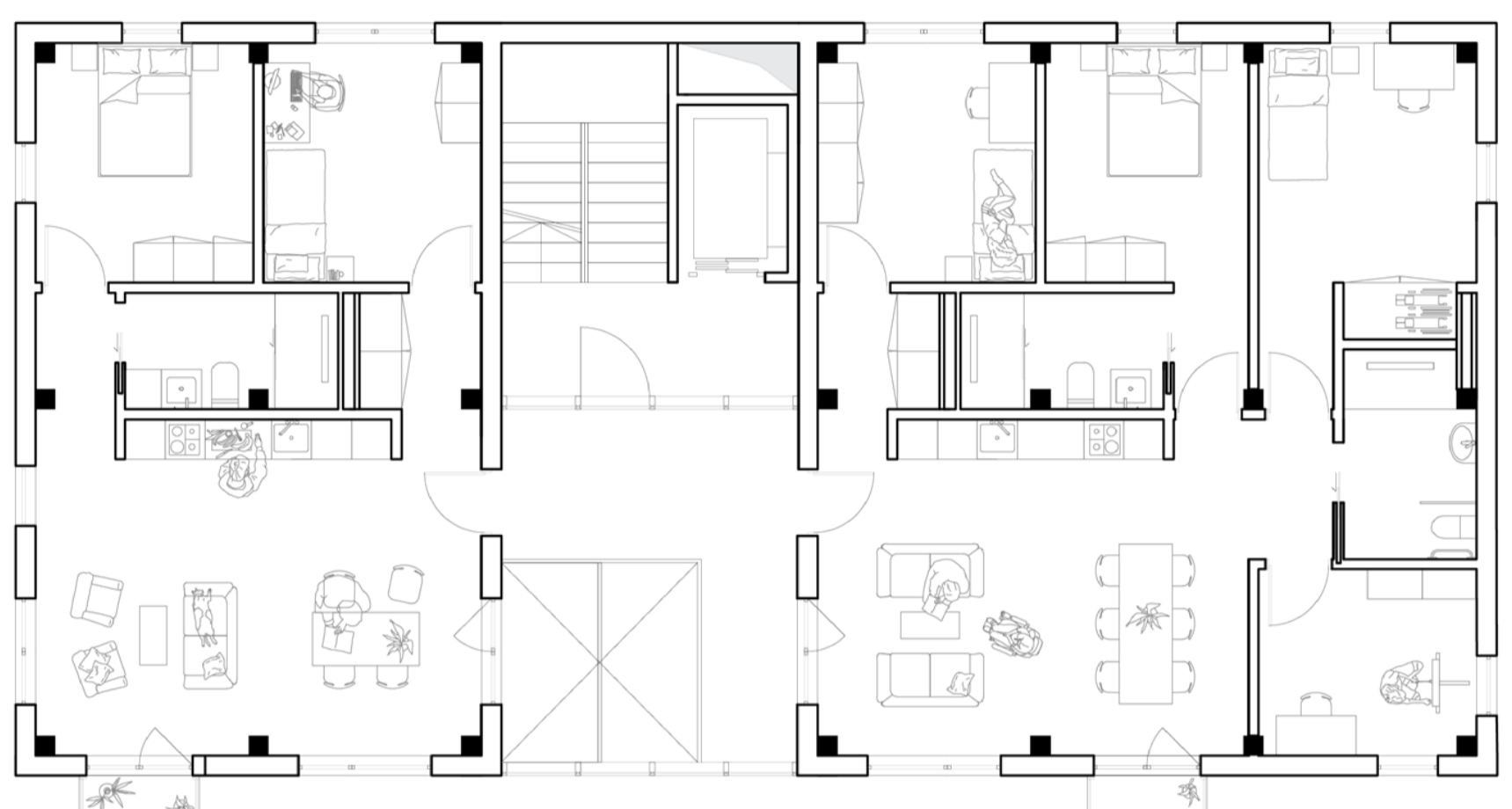
MODULE EXTENSION
3B3P/3B4P

2B2P* - „2-bedroom, 2-people“ etc.

REDUCE



CORE 1 - 2x2 bedroom dwelling
total 2-bedroom dwelling area - 67,5 m²



CORE 2 - 2-bedroom dwelling and 3-bedroom dwelling
total 3-bedroom dwelling area - 98,5 m²

REDUCE
fire protection, use of non-combustible materials
CONTRAFLAM 60-3
CLIMATOP EI60



REDUCE
water zone, natural cooling in the summer
sports and integration zone for the community (ice rink) in winter

REUSE
sustainable adaptation of the existing building with its expansion
increasing building efficiency through reuse

REDUCE
green roofs and walls
additional insulation on the north side

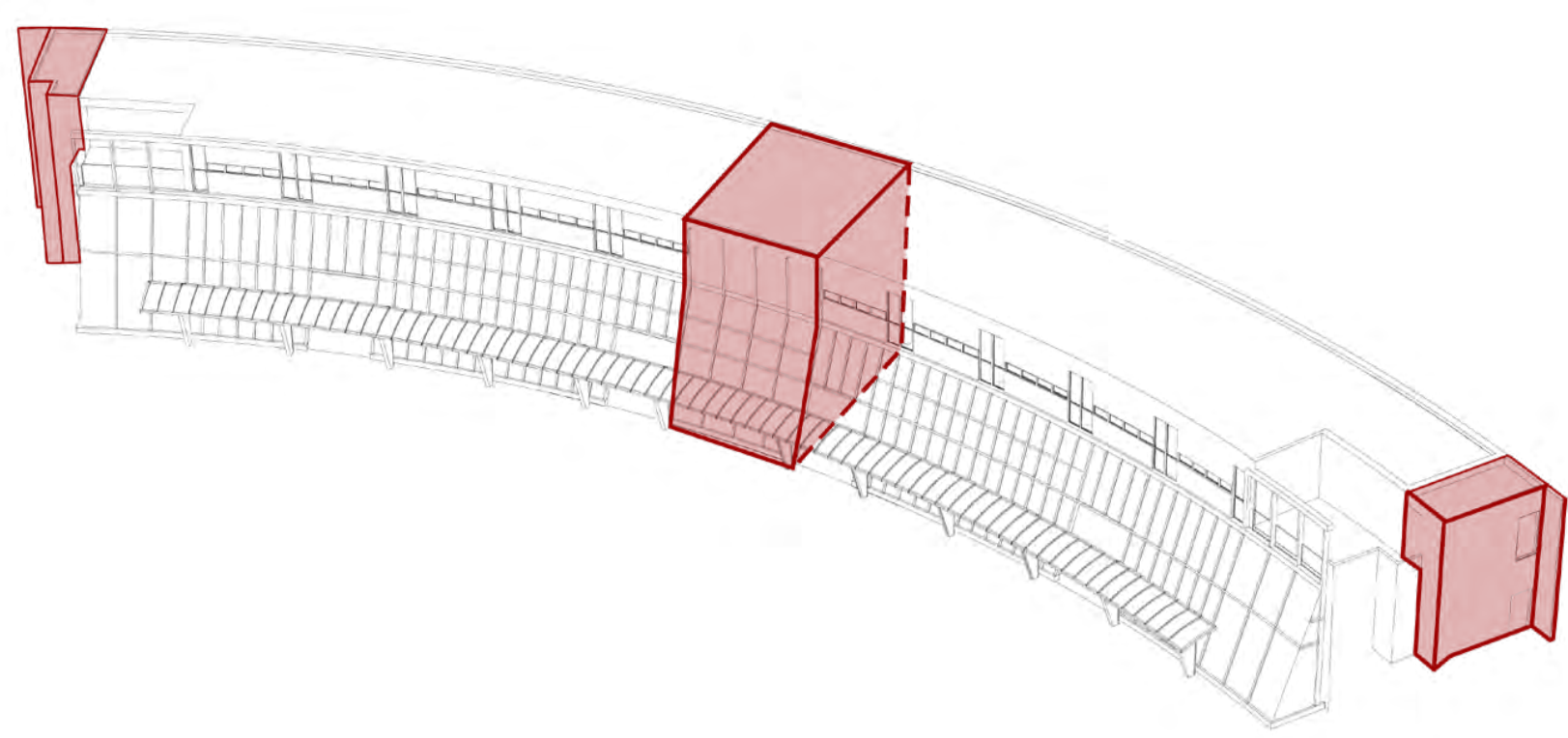


cross-section of the new building with elevations, 1:200

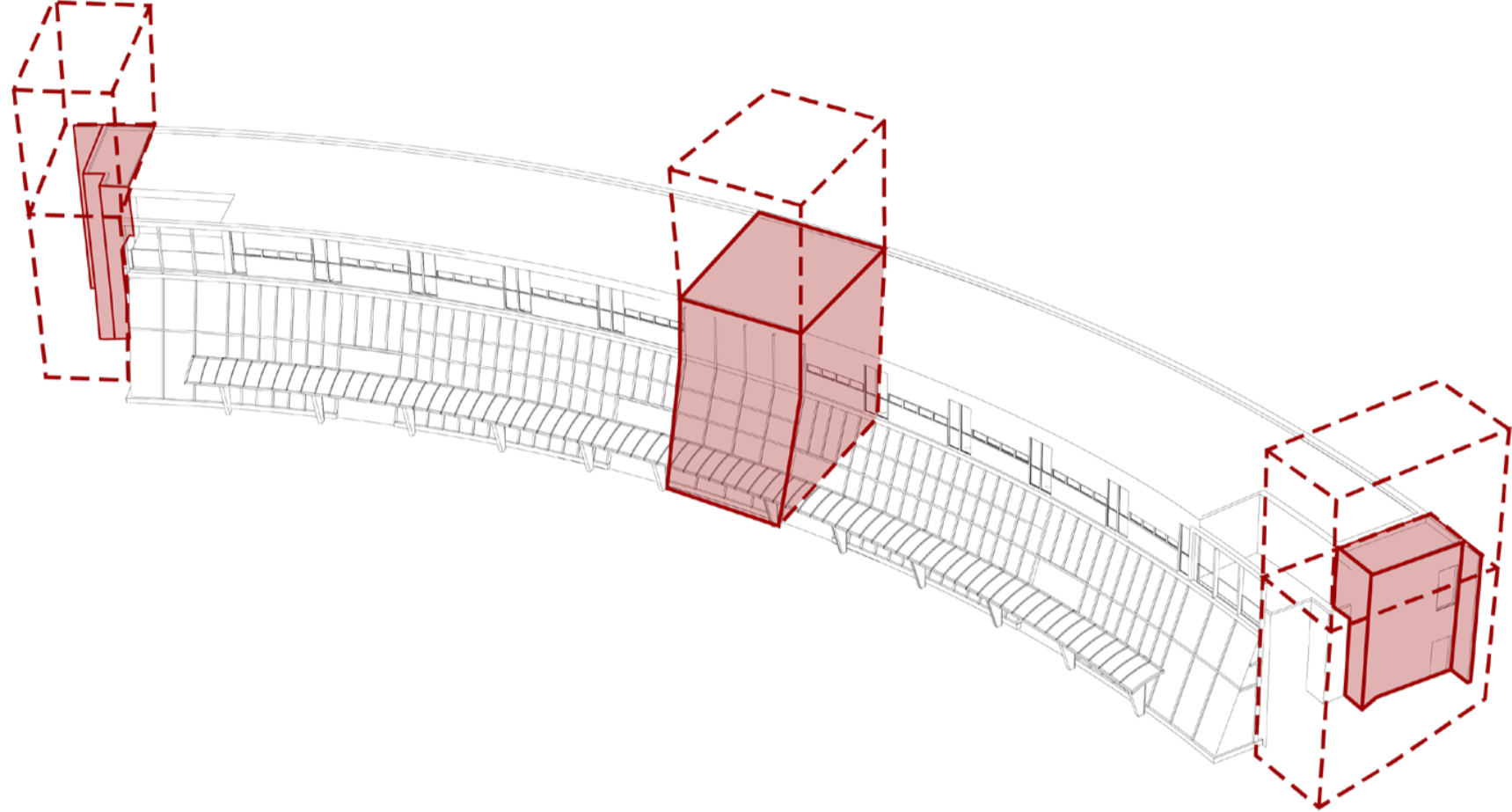


REDUCE
REUSE
PRODUCE

 **REDUCE**
less material use
fewer new communication spaces

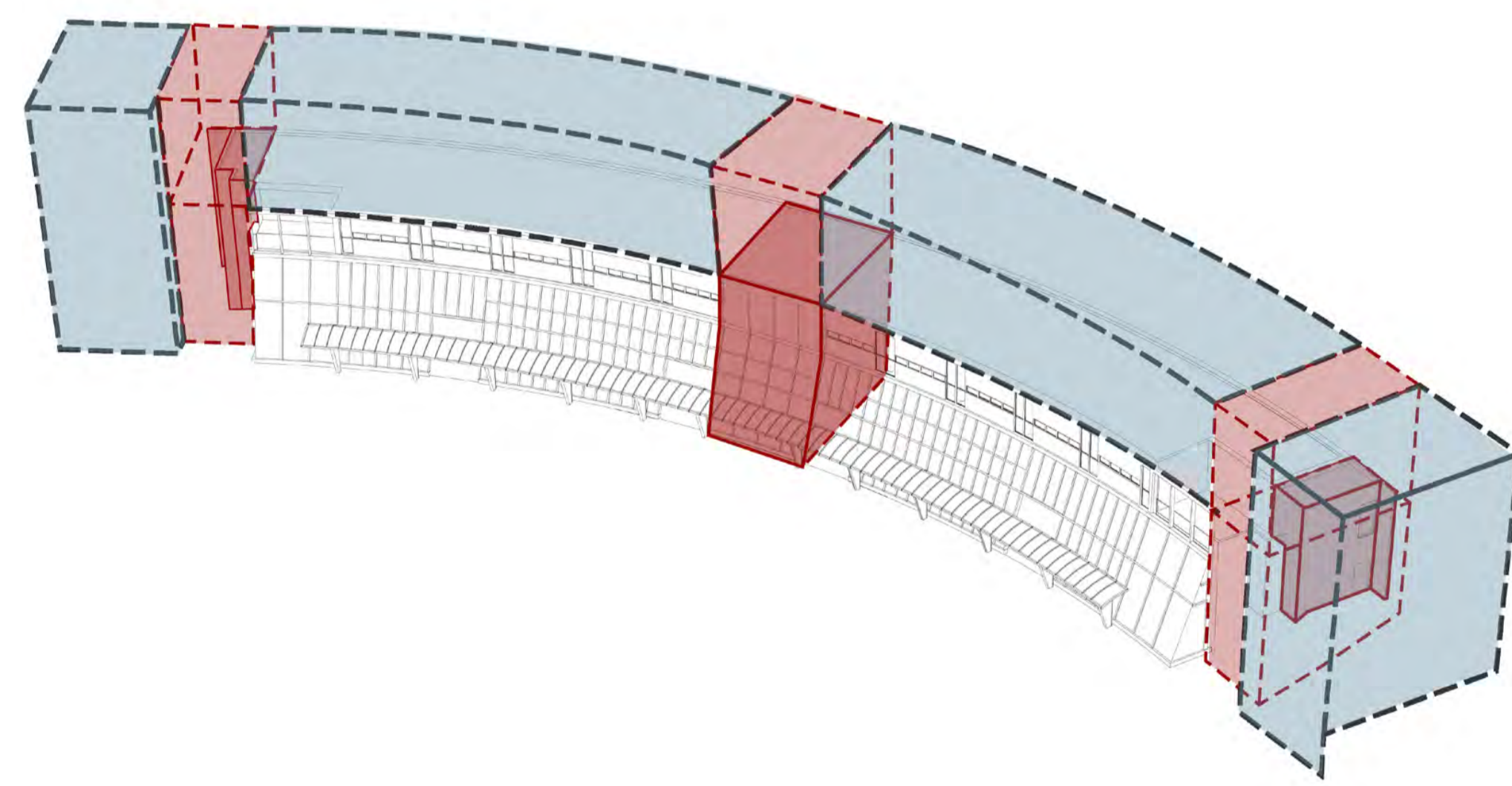


stage 1 - the existing building is the core for further architectural expansion






stage 2 - expand the existing communication vertically and horizontally


REUSE 
reuse of existing communication cores





stage 3 - new structure with new residential living spaces


-  residential spaces - co-living
-  researcher hostel
- administration, reading and meeting spaces
-  adaptation of the 2-level ground floor into a fabrication laboratory


REUSE
adaptation of the existing structure to a new space

 **PRODUCE**
fabrication laboratory on the ground floor is a place of ecological awareness with prefabrication factory open to residents and run by residents

 semi-private spaces - bioclimatic greenhouses


studio dwellings as co-living in the new structure 

residential spaces - co-living 

administration, reading and meeting spaces 

storage rooms and deposit

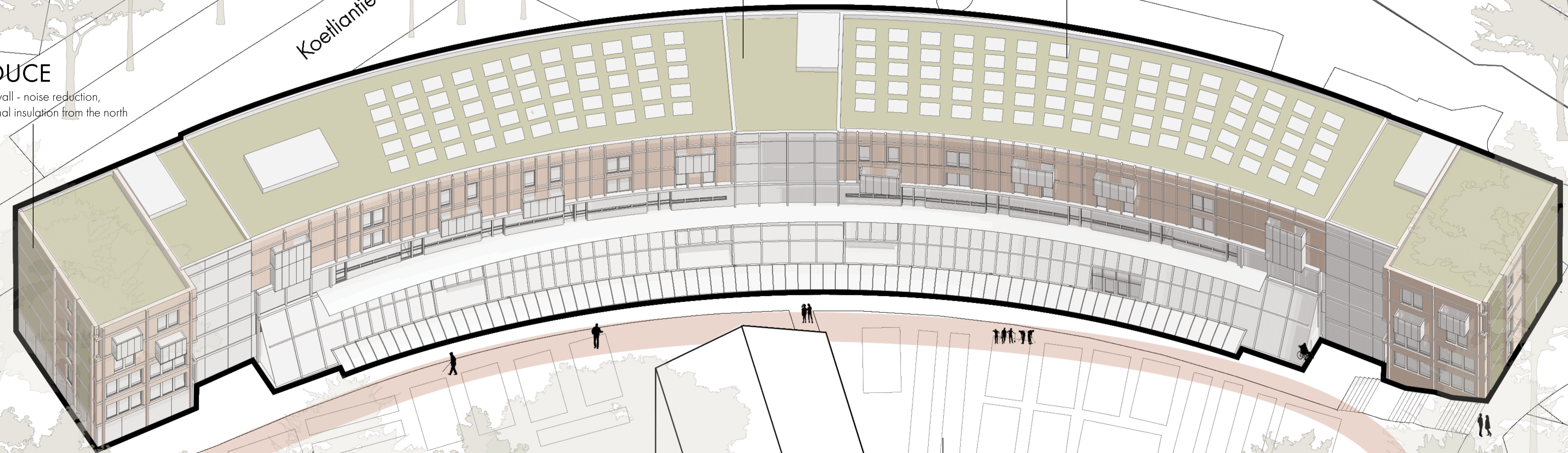
REDUCE
REUSE
PRODUCE


 **REDUCE**
green wall - noise reduction,
additional insulation from the north

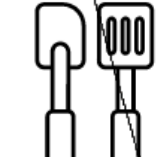
Koetlicantie

 **REDUCE**
energy-efficient green roofs, as additional insulation

 **PRODUCE**
use of renewable sources
to supply the building with electricity



Hakalantie  **REDUCE**
preserving existing trees as a natural barrier against noise and
air pollution, additional visual comfort for residents

 **PRODUCE**
community gardens - production of local food and integration of residents

RESEARCH
 REDUCE
 REUSE
 PRODUCE

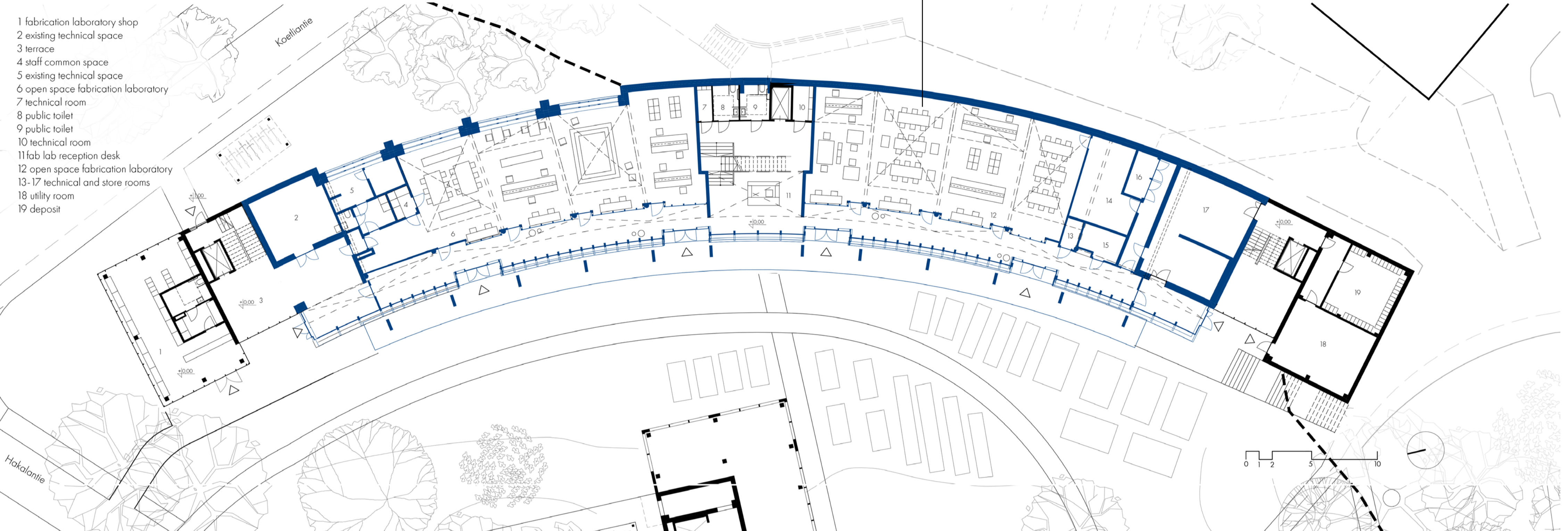


PRODUCE

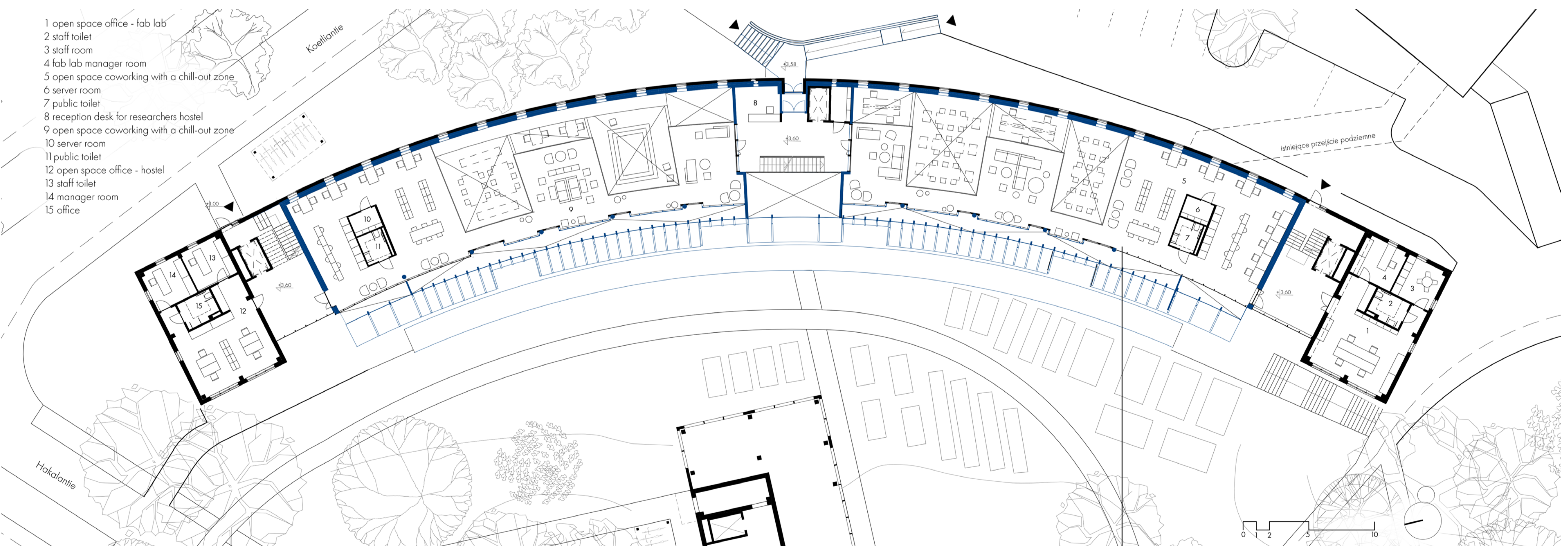
the ground floor facing the courtyard is being adapted into a fabrication laboratory, a hub for ecological awareness which promotes prefabrication



fabrication laboratory
 an integration space for residents



ground floor plan of the adapted building, 1:200



1st floor of the adapted building, 1:200



REUSE

1st floor has been transformed into a mezzanine with a coworking function and chill-out zone, it reduces work-commute, enable remote work, as well as facilitate mutual exchange of experiences



REDUCE
REUSE
PRODUCE

PRODUCE 

bioclimatic greenhouses - semi-private spaces
local food production and a place of social integration

 **RESEARCH**




Finnish vernacular patterns - using wood and prefabrication
to build core modules and for facade finishes

 **REUSE**

heat recovery, which is provided by a recuperation system
and amplified by the ground heat exchanger

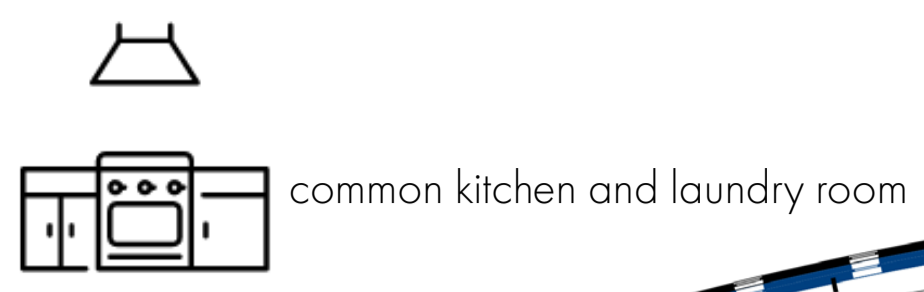


cross-section of the existing building with elevations, 1:200

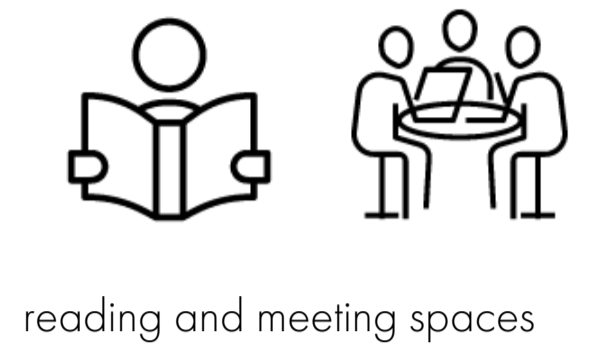
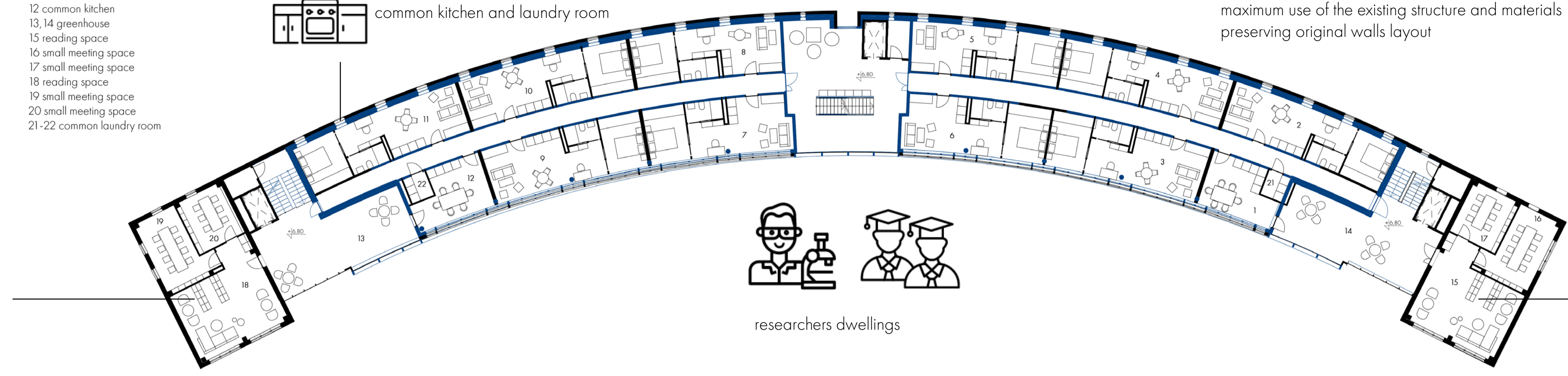
REUSE   
rainwater retention in underground reservoirs
grey water circulation

**REDUCE
REUSE**

- 1 common kitchen
- 2-11, researcher room 38,2-42,5 m2
- 12 common kitchen
- 13,14 greenhouse
- 15 reading space
- 16 small meeting space
- 17 small meeting space
- 18 reading space
- 19 small meeting space
- 20 small meeting space
- 21-22 common laundry room



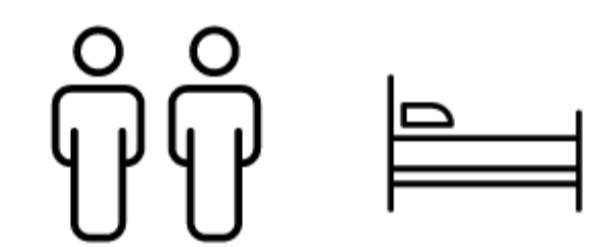
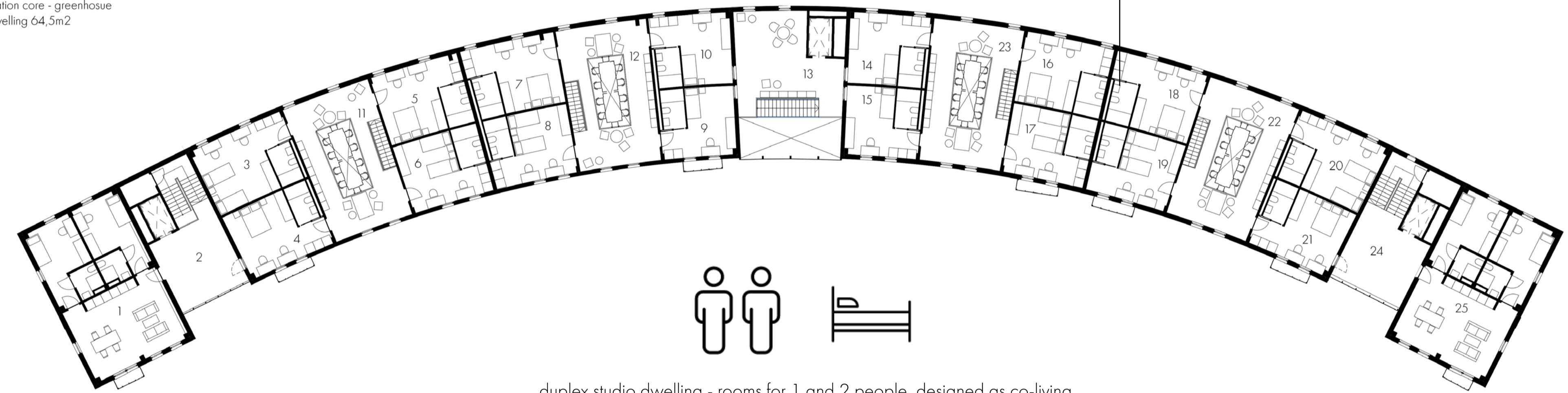
REUSE
maximum use of the existing structure and materials
preserving original walls layout



2nd floor of the adapted building - dwellings for researchers, 1:200

- 1 coliving dwelling 64,5m2
- 2 communication core - greenhouse
- 3-10, 2-bedroom studio dwellings as coliving 25,5-29,8 m2
- 11,12 common workspace zone 28,2 m2
- 13 communication core - greenhouse
- 14-21, 2-bedroom studio dwellings as coliving 25,5-29,8 m2
- 22,23 common workspace zone 28,2 m2
- 24 communication core - greenhouse
- 25 coliving dwelling 64,5m2

REDUCE
reduce the installation ducts length to a minimum



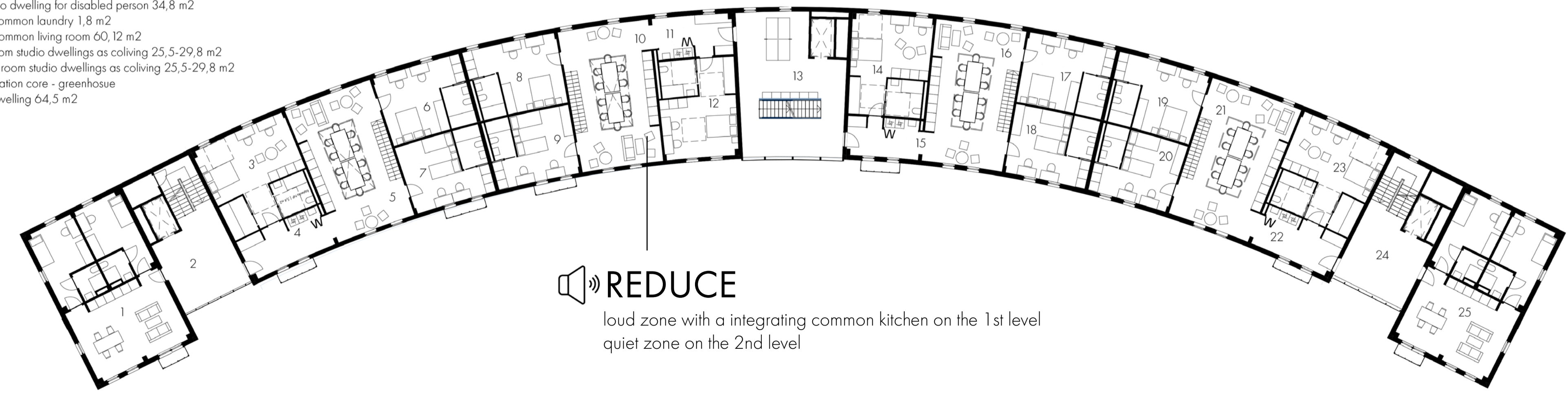
duplex studio dwelling - rooms for 1 and 2 people, designed as co-living

3rd floor of the adapted building - coliving studio modules, 1:200

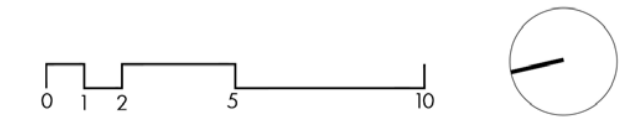


- 1 coliving dwelling 64,5 m2
- 2 communication core - greenhouse
- 3,14,23, studio dwelling for disabled person 34,8 m2
- 4,11,15,22, common laundry 1,8 m2
- 5,10,16,21, common living room 60,12 m2
- 6-9, 2-bedroom studio dwellings as coliving 25,5-29,8 m2
- 17-20, 2-bedroom studio dwellings as coliving 25,5-29,8 m2
- 24 communication core - greenhouse
- 25 coliving dwelling 64,5 m2

REDUCE
loud zone with an integrating common kitchen on the 1st level
quiet zone on the 2nd level



4th floor of the adapted building - coliving studio modules, 1:200



**REDUCE
REUSE
PRODUCE**

PV PANELS - ELECTRICITY PRODUCTION FROM RENEWABLE ENERGY SOURCE
ENERGY-EFFICIENT GREEN ROOF - EXTRA THERMAL INSULATION

REDUCE
energy-efficient green roofs, as additional insulation

REDUCE
solar gains, reduce heating demand

REDUCE

REDUCE
PLANITHERM II ONE
good daylight and thermal insulation



axonometry of existing building facade renovation

PREFABRICATED EXTERNAL CLT WALL

PRIVATE BIOCLIMATIC GREENHOUSE

FINISHING LAYERS TO THE EXISTING CONCRETE SLAB

EXISTING REINFORCED CONCRETE SLAB

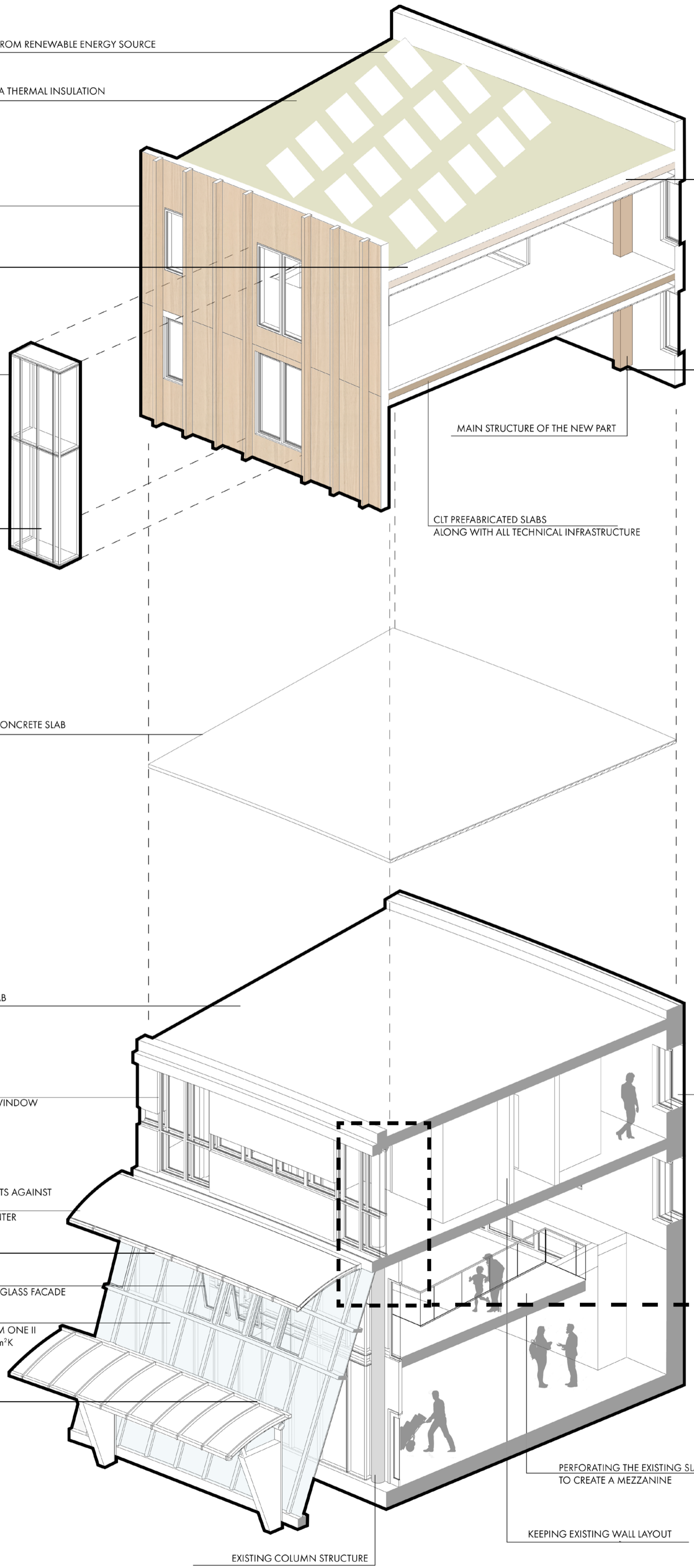
RETROFIT BY EXTRA INSULATION LAYER
CREATING TRADITIONAL CASEMENT WINDOW

EXTRA OUTDOOR OVERHANG PROTECTS AGAINST
OVERHEATING DURING SUMMER
AND ALLOWS SUNLIGHT DURING WINTER

NATURAL VENTILATION THANKS TO
OPENINGS IN THE UPPER PART OF THE GLASS FACADE

GLAZING IS REPLACED BY
Saint-Gobain Triple Glazing PLANITHERM ONE II
with g value 0.48, and Uglass = 1.5 W/m²K

EXISTING COLUMN STRUCTURE



MAIN STRUCTURE OF THE NEW PART

CLT PREFABRICATED SLABS
ALONG WITH ALL TECHNICAL INFRASTRUCTURE

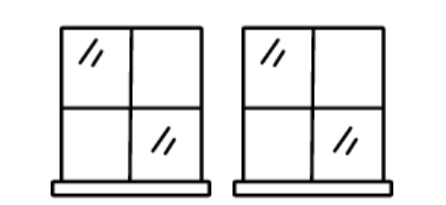
NEWLY DESIGNED
TRADITIONAL CASEMENT WINDOW

PERFORATING THE EXISTING SLAB
TO CREATE A MEZZANINE

KEEPING EXISTING WALL LAYOUT

PRODUCE
energy production from renewables

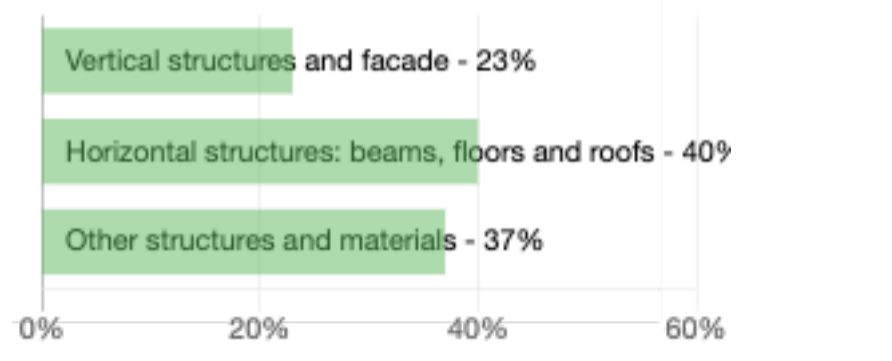
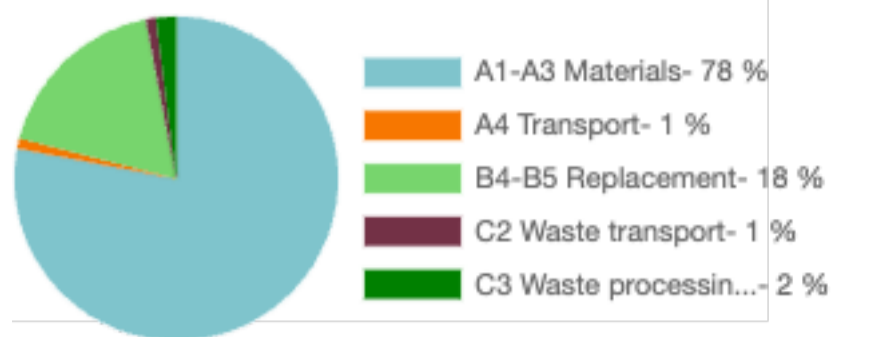
**RESEARCH
REDUCE**
use of local materials with a low carbon footprint,
easy, quick assembly and disassembly



RESEARCH
follow vernacular architecture
casement windows as additional insulation of
the building external walls
U=0.09 W/m²K



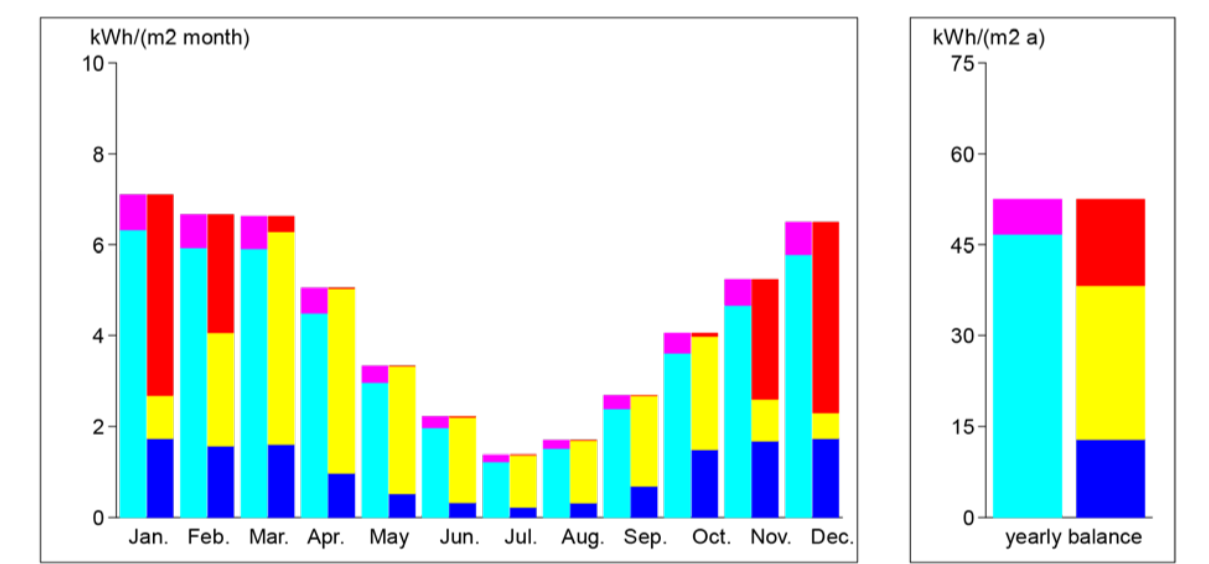
Cradle to grave (A1-A4, B4-B5, C1-C4)		kg CO ₂ e/m ²
< 320	A	64
320-360	B	
360-400	C	
400-440	D	
440-480	E	
480-520	F	
> 520	G	



REDUCE

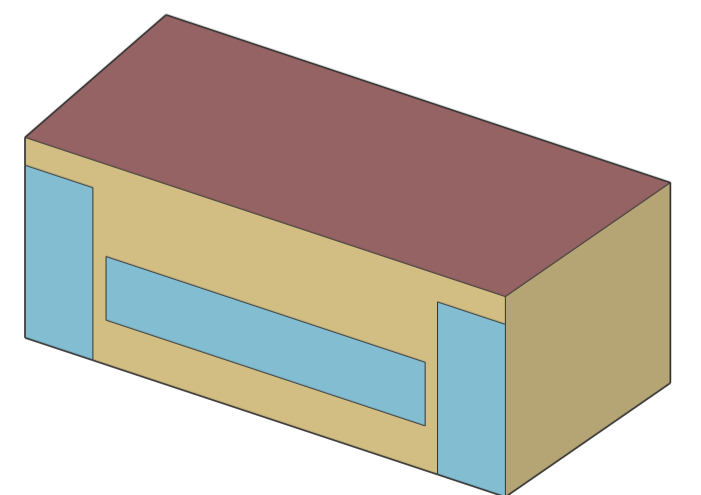
by utilizing locally sourced materials along with recycled ones, we significantly reduce the carbon footprint; renovated building achieved the best LCA coefficient and allowed for even less carbon footprint - it benefits beyond the system boundary due to its reuse

	Transmission losses in kWh/m2	Ventilation losses in kWh/m2	Total heat losses in kWh/m2	Internal gains in kWh/m2	Solar gains in kWh/m2	Usability factor	Heat energy demand in kWh/m2
January	6.3	0.8	7.1	1.7	0.9	1.00	4.4
February	5.9	0.7	6.7	1.6	2.5	1.00	2.6
March	5.9	0.7	6.6	1.6	4.7	0.92	0.3
April	4.5	0.5	5.0	1.0	4.1	0.58	0.0
May	3.0	0.4	3.3	0.5	2.8	0.30	0.0
June	2.0	0.2	2.2	0.3	1.9	0.19	0.0
July	1.2	0.1	1.4	0.2	1.2	0.12	0.0
August	1.5	0.2	1.7	0.3	1.4	0.18	0.0
September	2.4	0.3	2.7	0.7	2.0	0.40	0.0
October	3.6	0.4	4.1	1.5	2.5	0.85	0.1
November	4.7	0.6	5.2	1.7	0.9	1.00	2.6
December	5.8	0.7	6.5	1.7	0.6	1.00	4.2
Total (absolute) in kWh/a	83915	10217	94133	23067	45532		25534
Total (specific) in kWh/(m2.a)	46.8	5.7	52.5	12.9	25.4		14.2



ENERGY NEED FOR HEATING
14,2 kWh/m²a

simulation by CASANova



DAYLIGHT AUTONOMY
63.3 %

researcher single module

Autonomy [%]	Required [%]	Comply
63.3	60.0 %	Yes

simulation by SG SAVE plugin for SketchUp

REDUCE REUSE PRODUCE

1 external wall renovation
 $U = 0,10 \text{ W/m}^2\text{K}$
 existing concrete wall 240 mm
 existing insulation 150 mm
 woodfibre 20 mm
 ISOVER Renovation Roll Thermal (86% recyclable materials) 2x100 mm
 ISOVER Facade Tape
 VARIO® Facade Tape
 external plaster 15 mm

2 ground floor renovation
 $U = 0,10 \text{ W/m}^2\text{K}$
 existing concrete slab 180 mm
 ISOVER Renovation Roll Thermal (86% recyclable materials) 2x100 mm
 VARIO® membrane
 underfloor heating cables
 WEBER FLOOR 150 DURA screed 60 mm
 polyurethane foam 2 mm
 wooden flooring 14 mm

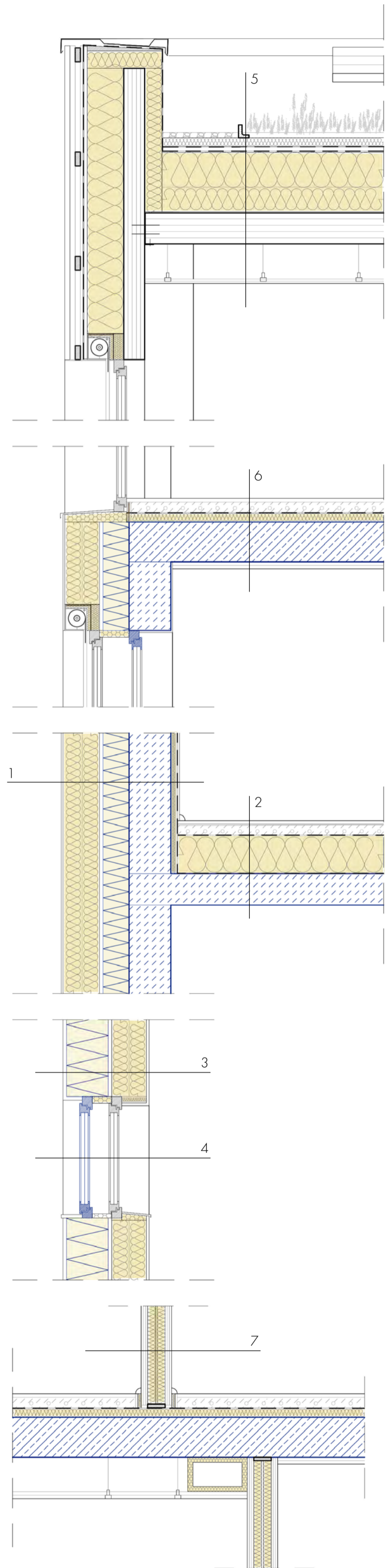
3 external wall renovation
 $U = 0,09 \text{ W/m}^2\text{K}$
 Gyproc WallBoard 125 mm
 existing insulation 200 mm
 woodfibre 20 mm
 ISOVER Renovation Roll Thermal (86% recyclable materials) 2x100 mm
 ISOVER Facade Tape
 VARIO® Facade Tape
 external plaster 15 mm

4 glazing replacement
 $U=0,07 \text{ W/m}^2\text{K}$
 the existing glass facade allows to keep the main structure and replace the existing glazing with high performance glazing removed glazing is going to be recycled U-value - Saint-Gobain Triple Glazing PLANITHERM ONE II with g-value 0.48, and U_{glass} = 1.5 W/m²K

5 new CLT Prefab energy-efficient extensive green roof with PV panels
 $U=0,07 \text{ W/m}^2\text{K}$
 RIGIMETR 4PRO plasterboard 2x125 mm
 CLT plate 180 mm
 Vapour barrier
 ISOVER ROBUST Ceiling Panel 380 mm
 ISOVER ROBUST Ceiling Board 40 mm
 Water-proofing resistant to root penetration
 Protective geotextiles
 Drainage dimpled membrane
 Filter fabric
 ISOVER Flora hydrophilic panels 50 mm
 Extensive mineral substrate 30 mm
 Extensive vegetation

6 ceiling between units
 $R'/A, 1,ie. = 64 \text{ dB}$
 RIGIMETR 4PRO plasterboard 2x125 mm
 RIGIPIS ULTRASRIL profile and mounting accessories
 air gap 250 mm
 CLIMAVER® self-supporting ducts
 existing concrete slab 230 mm
 GLAVA FOOTSTEP IMPACT SOUND BOARD mat 20 mm
 APRORO DECIBEL 4 acoustic mat 12 mm
 underfloor heating cables
 WEBER FLOOR 150 DURA screed 60 mm
 polyurethane foam 2 mm

7 wall between units
 $R'/A, 1,ie. = 69 \text{ dB}$
 Gyproc GHE 13 Habito plasterboard 2x125 mm
 Gyproc GNE 13 Normal plasterboard 2x125 mm
 ISOVER Piano Sound Board 45 mm
 air gap 10 mm
 ISOVER Piano Sound Board 45mm
 Gyproc GHE 13 Habito plasterboard 2x125 mm
 Gyproc GNE 13 Normal plasterboard 2x125 mm




REDUCE 
 natural ventilation

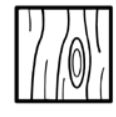
REDUCE 
 well-insulated building envelope
 minimizing energy need for heating by retrofit

PRODUCE 
 electricity production with use of renewables

REDUCE 
 natural absorption of pollutants
 additional lighting in summer
 shading in winter

REDUCE 
 additional shading overhang provide proper shading in summer and allows more daylight during winter





since 1500s

„domestic wood was practically a free construction material; in traditional Finnish peasant houses, wood was even used as a roofing material”¹



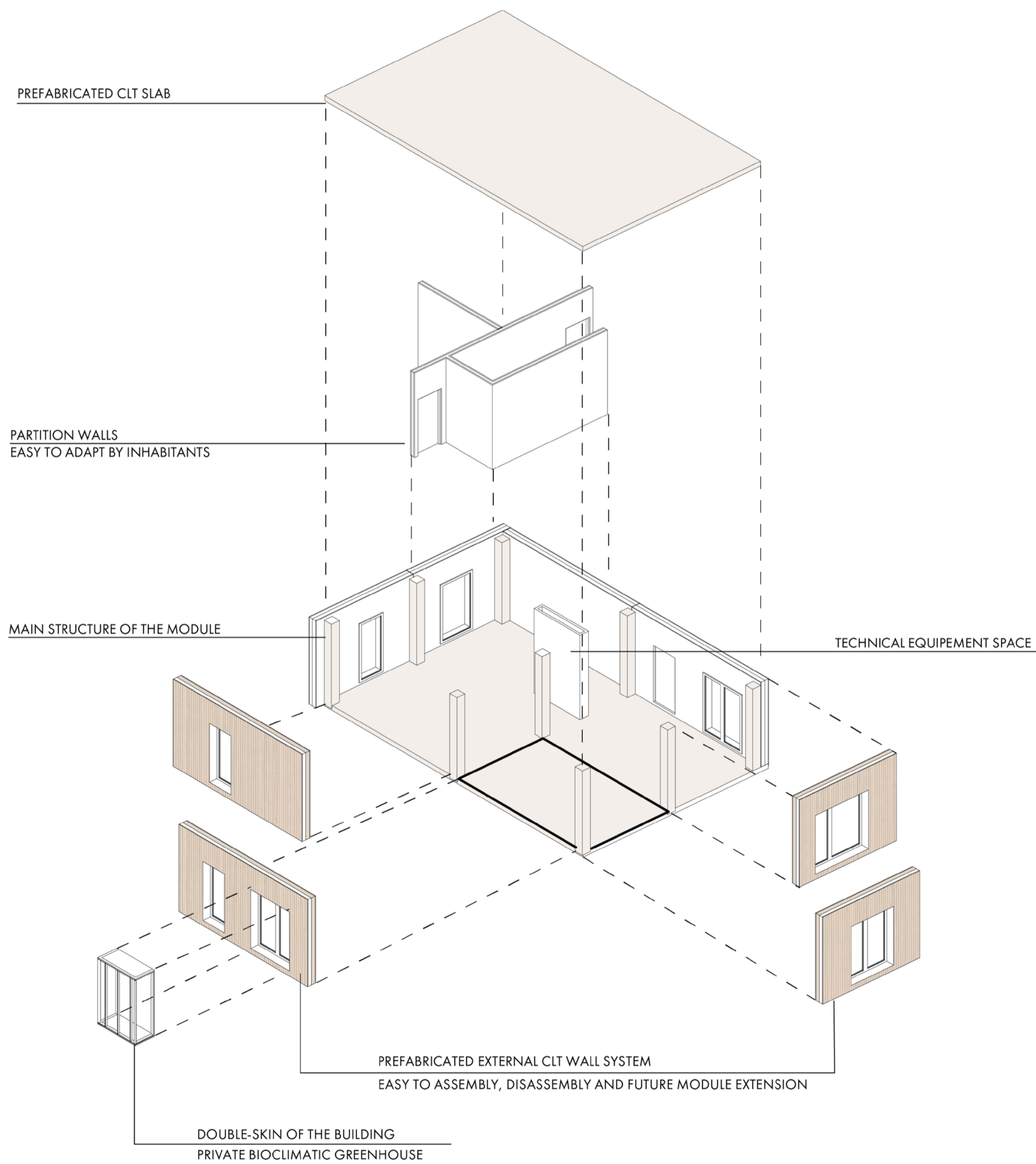
1900s

development of the prefabrication, experimenting Puutalo Oy housing rintamamiestalo - front-line soldier's house

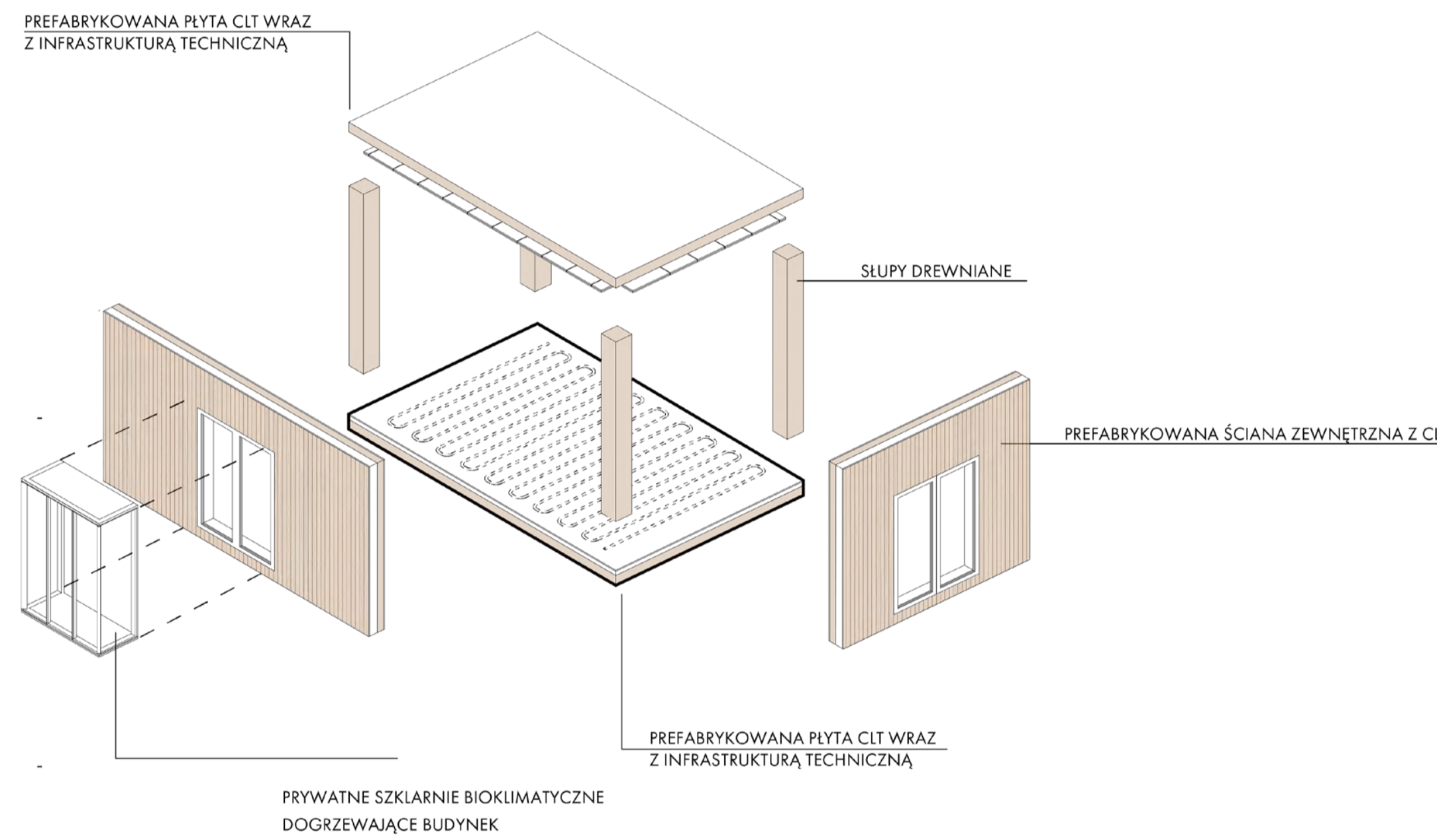


now and the future

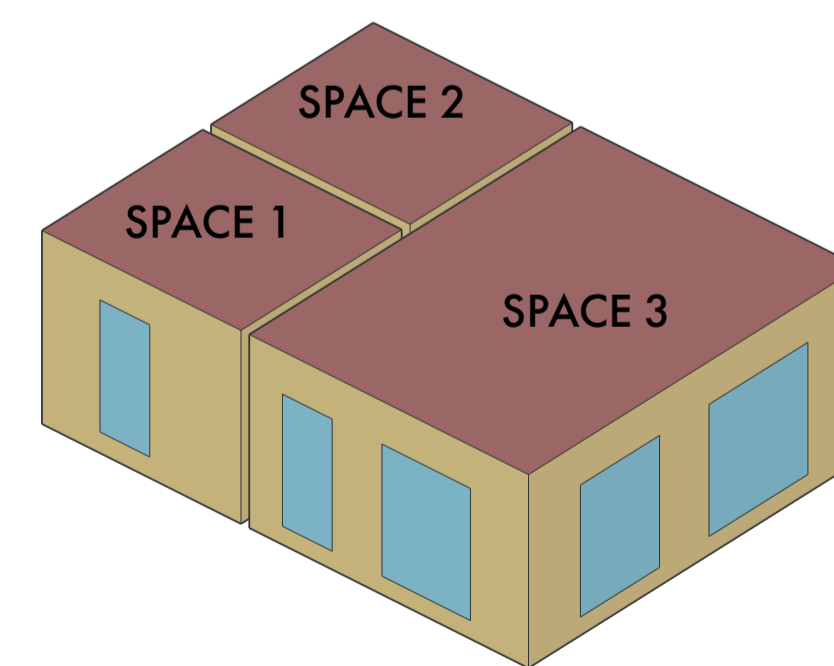
master in prefabrication core houses



axonometric view of the residential module



axonometric view of the single module



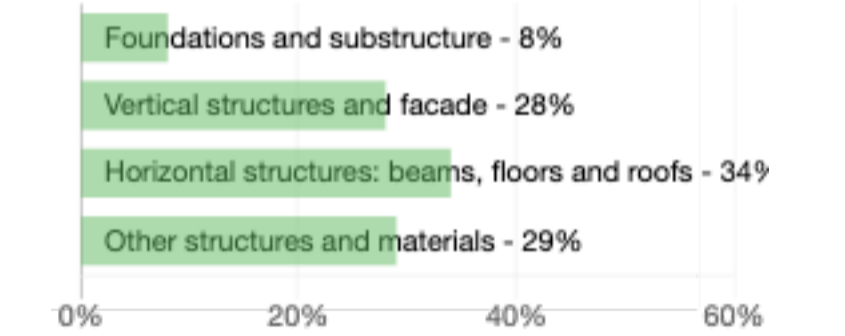
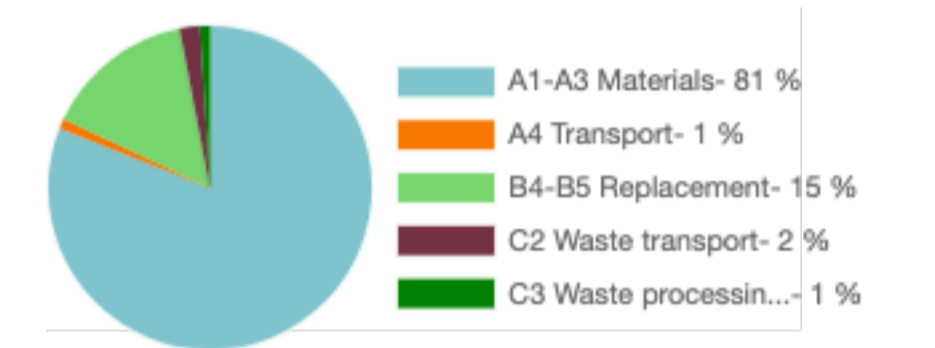
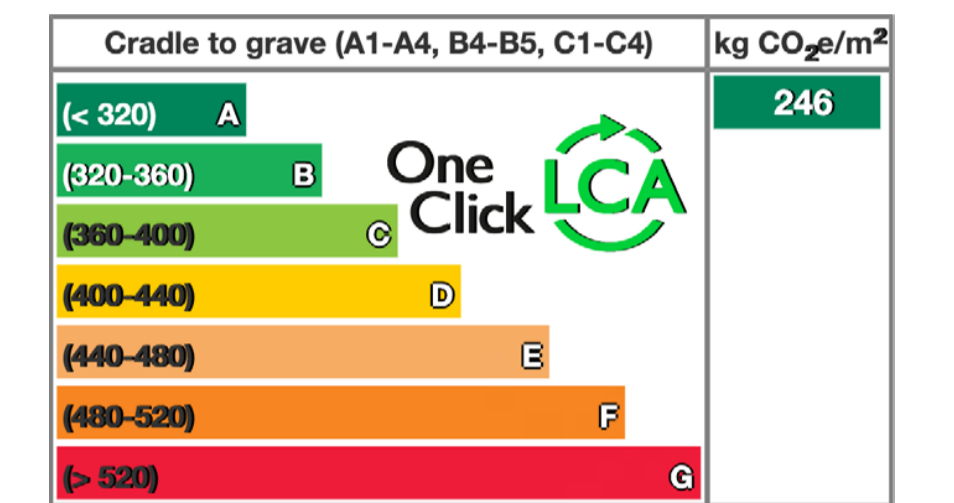
DAYLIGHT AUTONOMY
 67.9 % - SPACE 1
 60.3 % - SPACE 2
 73.0 % - SPACE 3
 2-bedroom dwelling

Lighting autonomy 300 Lux

TZ: SPACE 1 DAYLIGHTINGCONTROLS
 TZ: SPACE 2 DAYLIGHTINGCONTROLS
 TZ: SPACE 3 DAYLIGHTINGCONTROLS

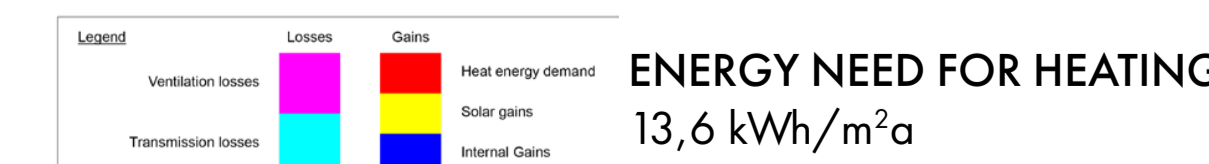
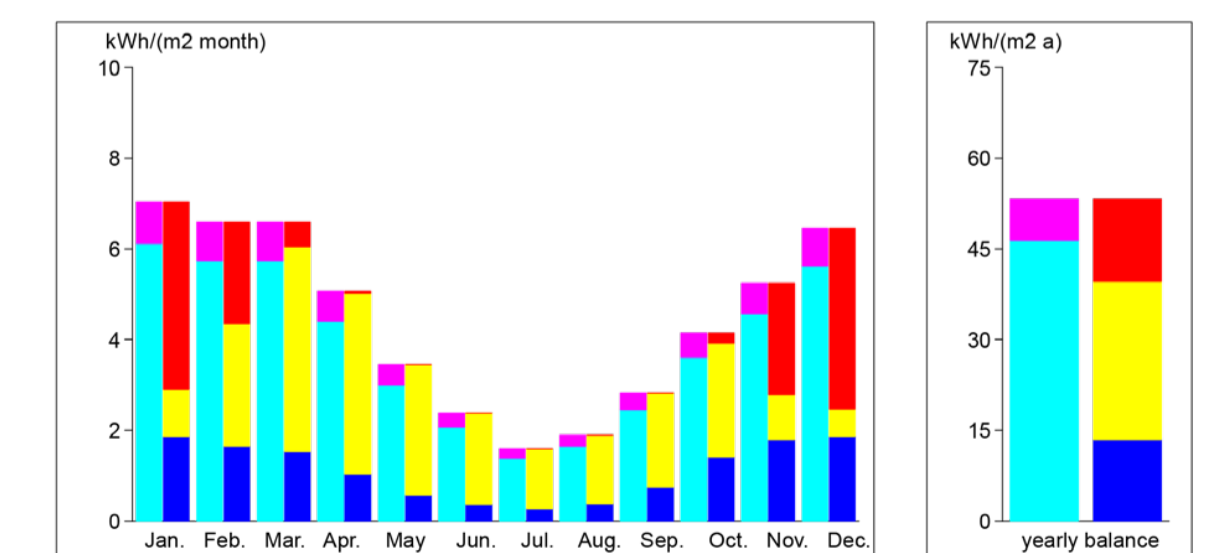
Autonomy [%]	Required [%]	Comply
67,9	60,0 %	Yes
60,3	60,0 %	Yes
73,0	60,0 %	Yes

simulation by SG SAVE plugin for SketchUp



life cycle assesment for a new structure module

	Transmission losses in kWh/m2	Ventilation losses in kWh/m2	Total heat losses in kWh/m2	Internal gains in kWh/m2	Solar gains in kWh/m2	Usability factor	Heat energy demand in kWh/m2
January	6,1	0,9	7,0	1,9	1,0	1,00	4,1
February	5,7	0,9	6,6	1,6	2,7	0,99	2,2
March	5,7	0,9	6,6	1,5	4,5	0,82	0,5
April	4,4	0,7	5,1	1,0	4,0	0,58	0,1
May	3,0	0,4	3,5	0,6	2,9	0,31	0,0
June	2,1	0,3	2,4	0,4	2,0	0,20	0,0
July	1,4	0,2	1,6	0,3	1,3	0,14	0,0
August	1,6	0,2	1,9	0,4	1,5	0,20	0,0
September	2,5	0,4	2,9	0,7	2,1	0,41	0,0
October	3,6	0,5	4,1	1,4	2,5	0,78	0,2
November	4,6	0,7	5,2	1,8	1,0	0,99	2,5
December	5,6	0,8	6,5	1,9	0,6	1,00	4,0
Total (absolute) in kWh/a	30604	4545	35149	8904	17250		8994
Total (specific) in kWh/(m2 a)	46,4	6,9	53,3	13,5	26,1		13,6



simulation by CASANova

¹ <https://www.archinfo.fi/en/articles/wood-only-the-history-of-finnish-wood-construction>, access 3.05.2024

REDUCE
REUSE
PRODUCE



PRODUCE
electricity production using roof-integrated photovoltaic panels

REDUCE
a greenhouse is an unheated, semi-private zone, passively heated and naturally ventilated

1 new CLT Prefab wall
 $U=0,12 \text{ W/m}^2\text{K}$

GYPROC GNE 13 Normal 125 mm
CLT wall 120 mm
ISOVER Vario@ Xtra
ISOVER PLUS Stud 245 mm
facade timber construction
facade wooden cladding 25 mm

2 new CLT Prefab roof
 $U=0,07 \text{ W/m}^2\text{K}$

RIGIMETR 4PRO plasterboard 2x125 mm
CLT plate 180 mm
Vapour barrier
ISOVER ROBUST Ceiling Panel 380 mm
ISOVER ROBUST Ceiling Board 40 mm
waterproof layer
battens and counter battens
integrated with roof photovoltaic panel

3 ground floor renovation
 $U = 0,10 \text{ W/m}^2\text{K}$

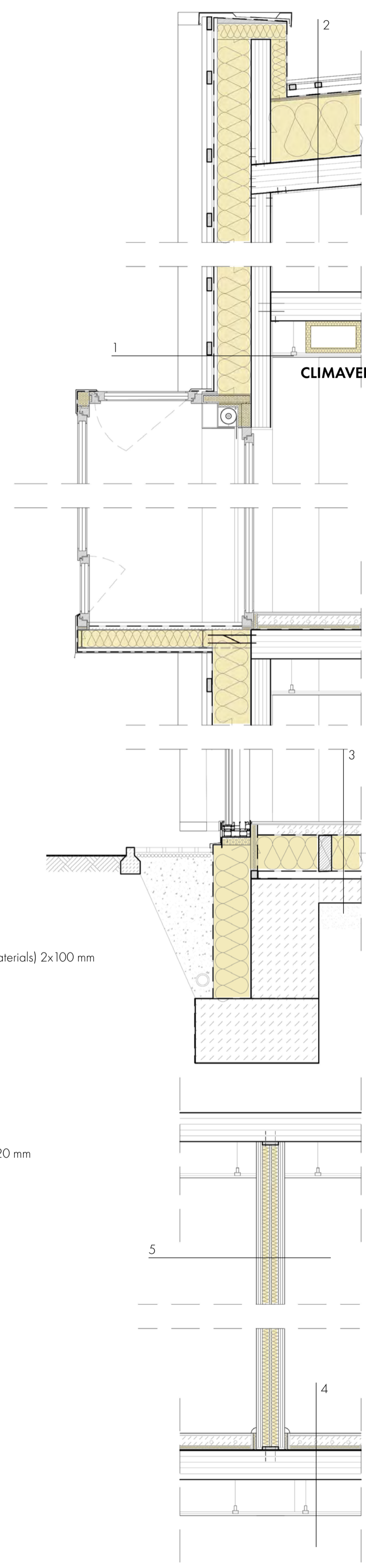
ENIVOMIX Ultra Low Carbon Concrete 150 mm
breathable mesh
air gap 50 mm
ISOVER Renovation Roll Thermal (86% recyclable materials) 2x100 mm
VARIO@ membrane
underfloor heating cables
WEBER FLOOR 150 DURA screed 60 mm
polyurethane foam 2 mm

4 new CLT Prefab slab
 $R'/A, 1,ie. = 64 \text{ dB}$

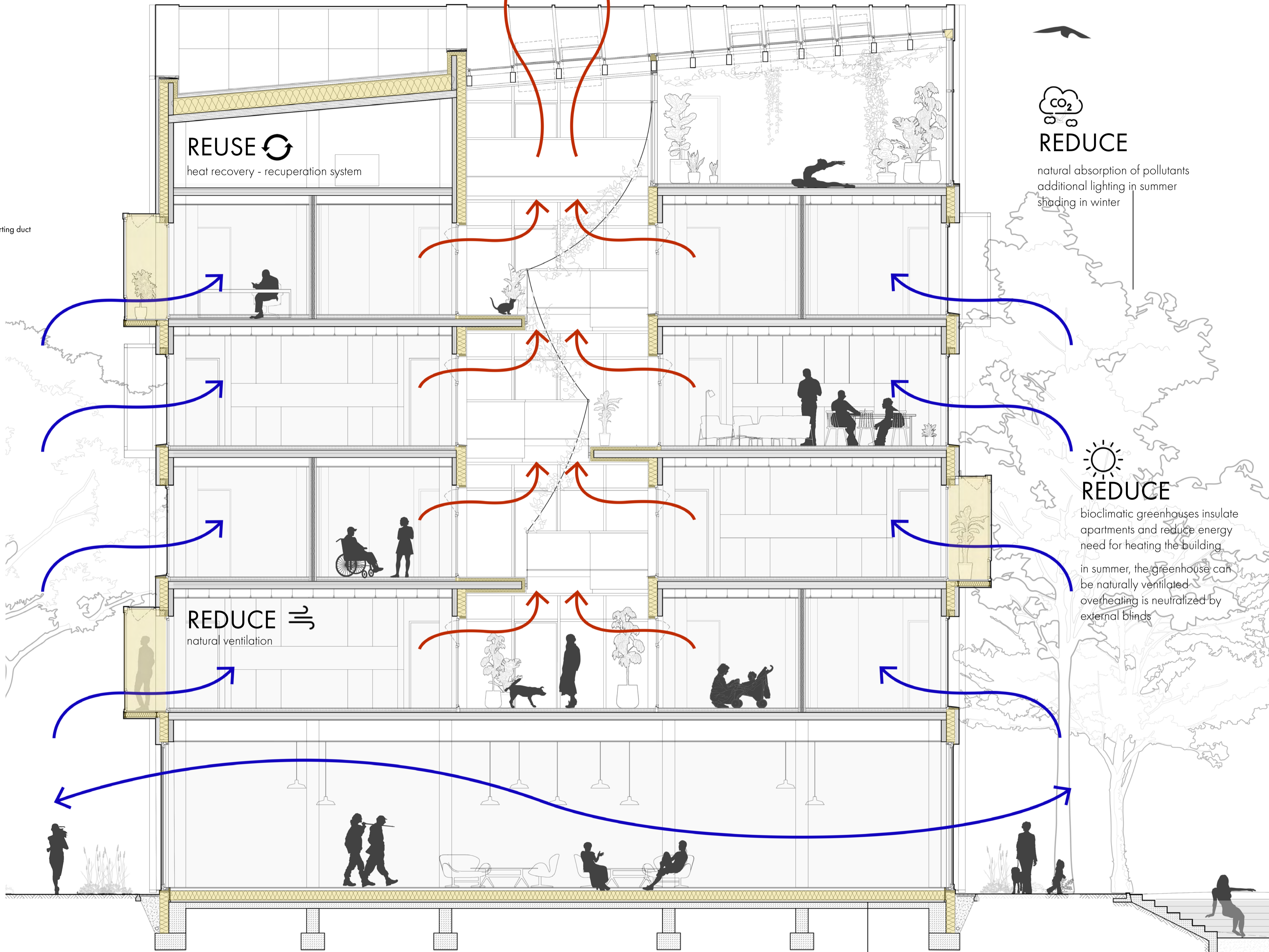
RIGIMETR 4PRO plasterboard 2x125 mm
CLT plate 180 mm
GLAVA FOOTSTEP IMPACT SOUND BOARD mat 20 mm
APROBO DECIBEL 4 acoustic mat 12 mm
underfloor heating cables
WEBER FLOOR 150 DURA screed 60 mm
polyurethane foam 2 mm
wooden flooring 14 mm

5 partition wall between units
 $R'/A, 1,ie. = 69 \text{ dB}$

Gyproc GHE 13 Habito plasterboard 2x125 mm
Gyproc GNE 13 Normal plasterboard 2x125 mm
ISOVER Piano Sound Board 45 mm
air gap 10 mm
ISOVER Piano Sound Board 45mm
Gyproc GHE 13 Habito plasterboard 2x125 mm
Gyproc GNE 13 Normal plasterboard 2x125 mm



details, 1:20



REDUCE
natural absorption of pollutants
additional lighting in summer
shading in winter

REDUCE
bioclimatic greenhouses insulate apartments and reduce energy need for heating the building
in summer, the greenhouse can be naturally ventilated - overheating is neutralized by external blinds

REDUCE
well-insulated building envelope
minimizing energy need for heating

core house longitudinal section, 1:50

RURBAN HABITAT

RESEARCH
REDUCE
REUSE
PRODUCE
INTEGRATE

