

CLIMATE CONDENSERS

Eco-conscious public condensers to encourage
pro-environmental behavior

PUBLIC BUILDING MSC3 AR3AP100 | PUBLIC CONDENSER, COPENHAGEN
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TBD - INSTRUCTOR | IR. ELINA KARANASTASI
TD - INSTRUCTOR | DR. STEFANO CORBO

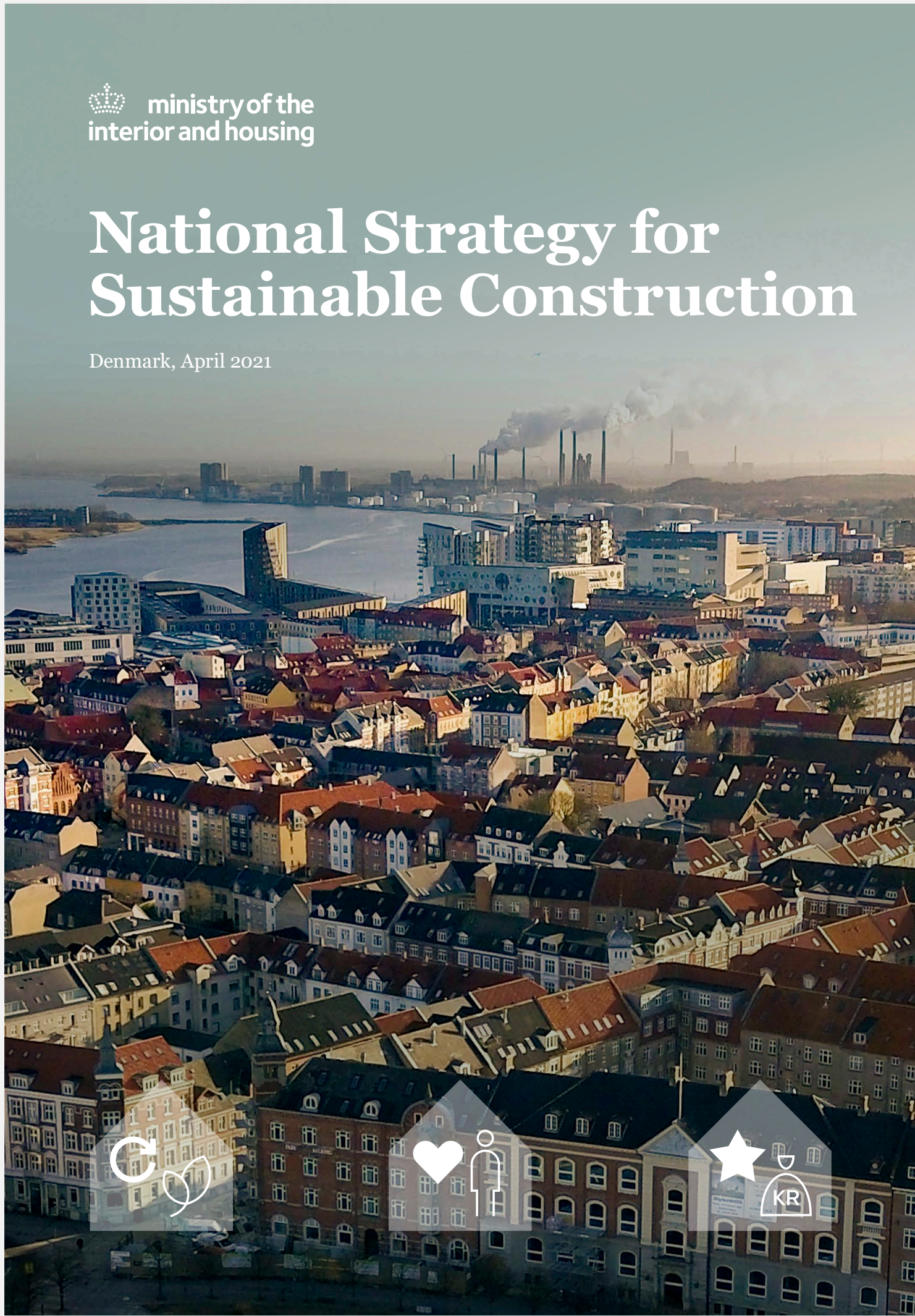


ONE CENTRAL PARK



National Strategy for Sustainable Construction

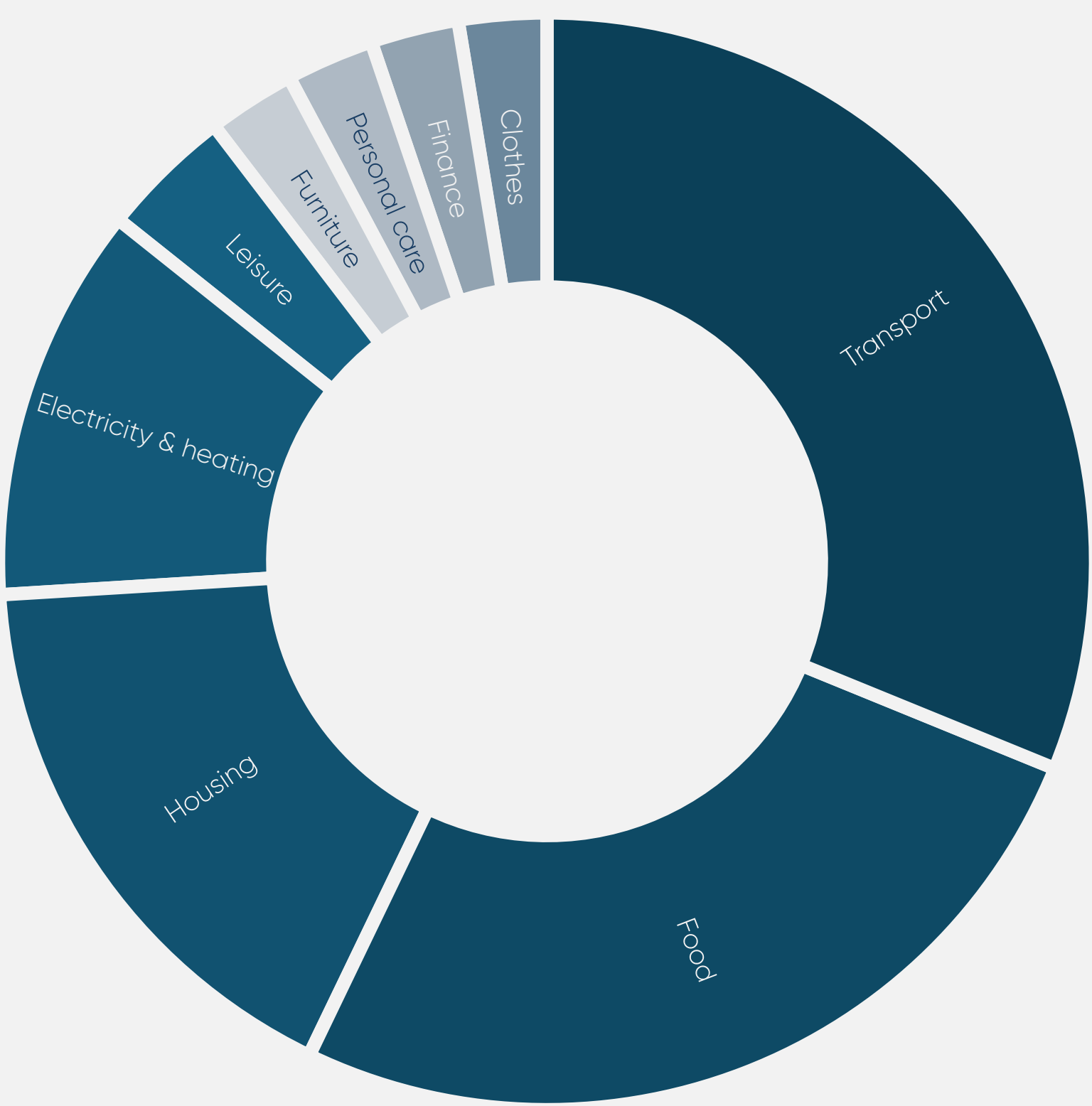
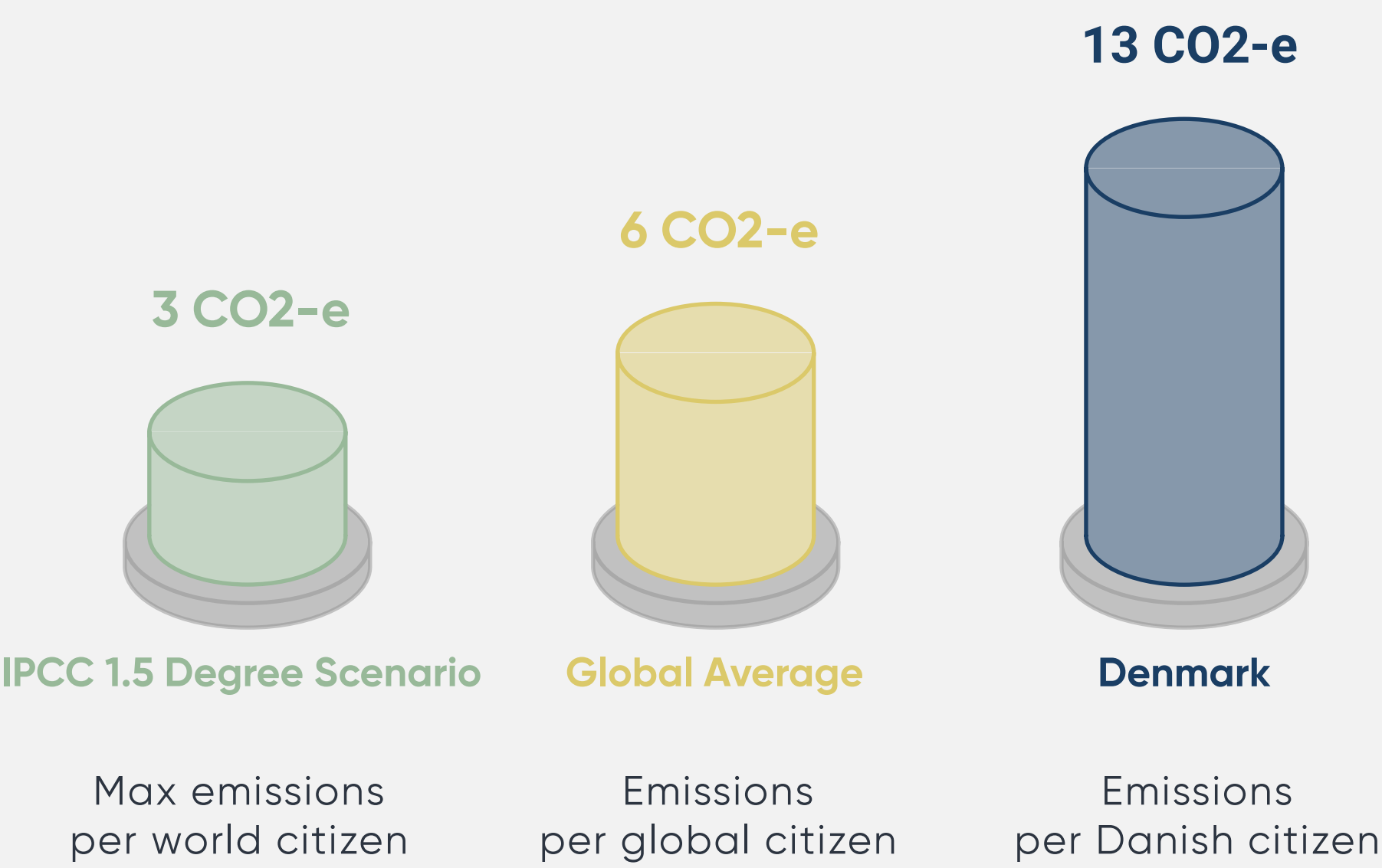
Denmark, April 2021



		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
 More climate friendly buildings and construction	1.	Regulation based on the voluntary sustainability standard									
	2.	Phasing in a threshold limit value for the climate footprint of buildings									
	3.	Further development of life-cycle assessment and total economic calculations for design tools									
	4.	Coordination committee for sustainable construction									
	5.	Enhanced Nordic cooperation in the area of sustainability									
	6.	Work for sustainability in the revision of the Construction Products Regulation									
	7.	Promote fossil-free construction sites									
 Durable, high quality buildings	8.	Investigate the possibility of introducing CO ₂ reduction considerations into tenders									
	9.	Analysis of potential for more sustainable constructions (green check of Eurocodes)									
	10.	Safe and healthy recycling in construction									
	11.	Promote climate-friendly building materials									
	12.	Development of more accurate environmental data on materials									
	13.	Holistic assessments for refurbishments									
 Resource efficient buildings	14.	Strategic survey and investigation of flaws and deficiencies									
	15.	Less waste of materials on construction sites									
	16.	Collation of examples of cheap sustainable construction									
	17.	Proposals for reduced requirements for the establishment of parking areas									
 Energy efficient, healthy buildings	18.	Clarification of the possibilities of expanding special transport regarding modular construction									
	19.	Targeted energy efficiency efforts									
 Digitally supported construction	20.	Subsidies for energy savings in households and businesses									
	21.	The public housing sector as a frontrunner for digitization of the entire building life cycle									

DANISH FOOTPRINT

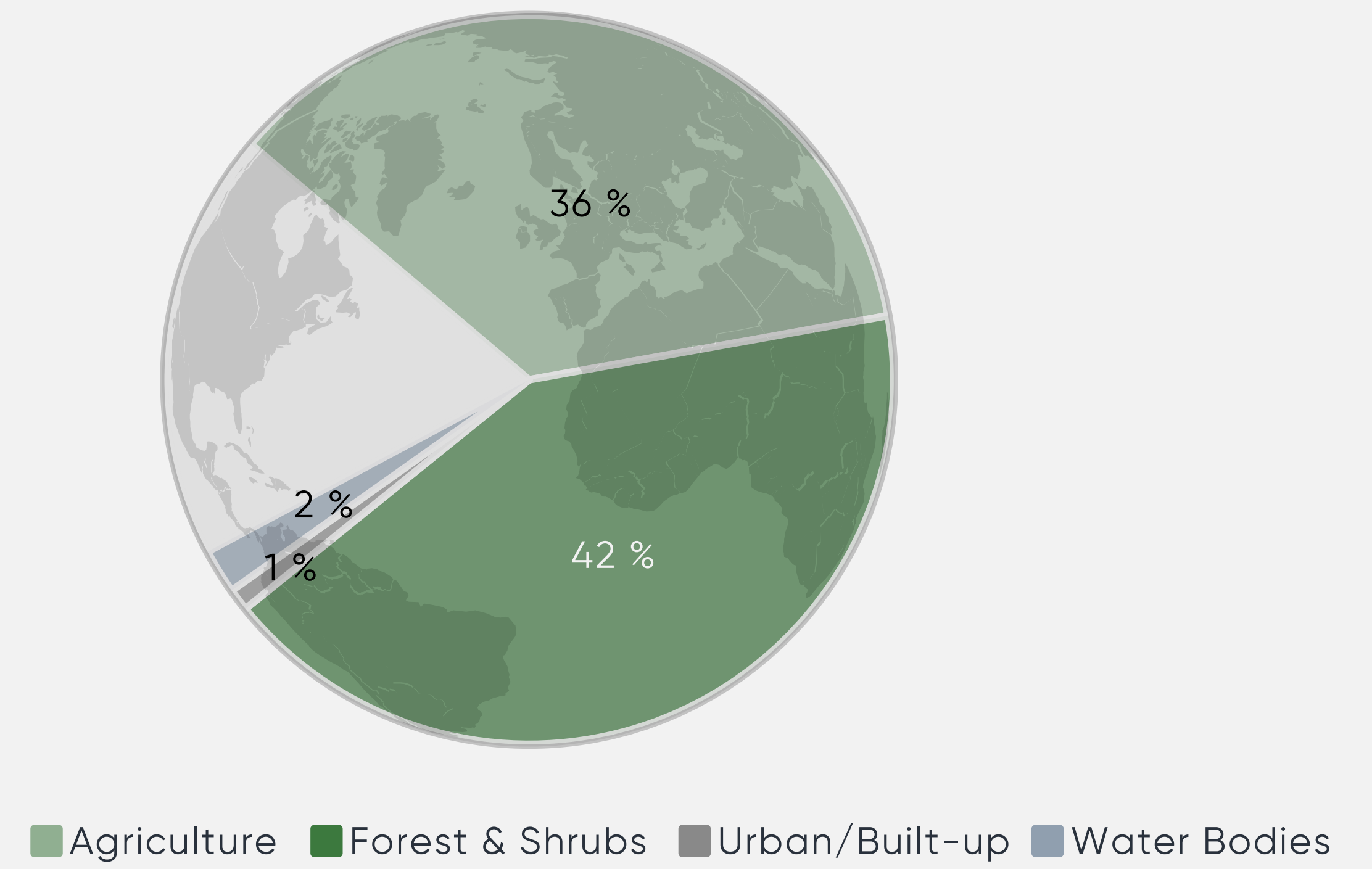
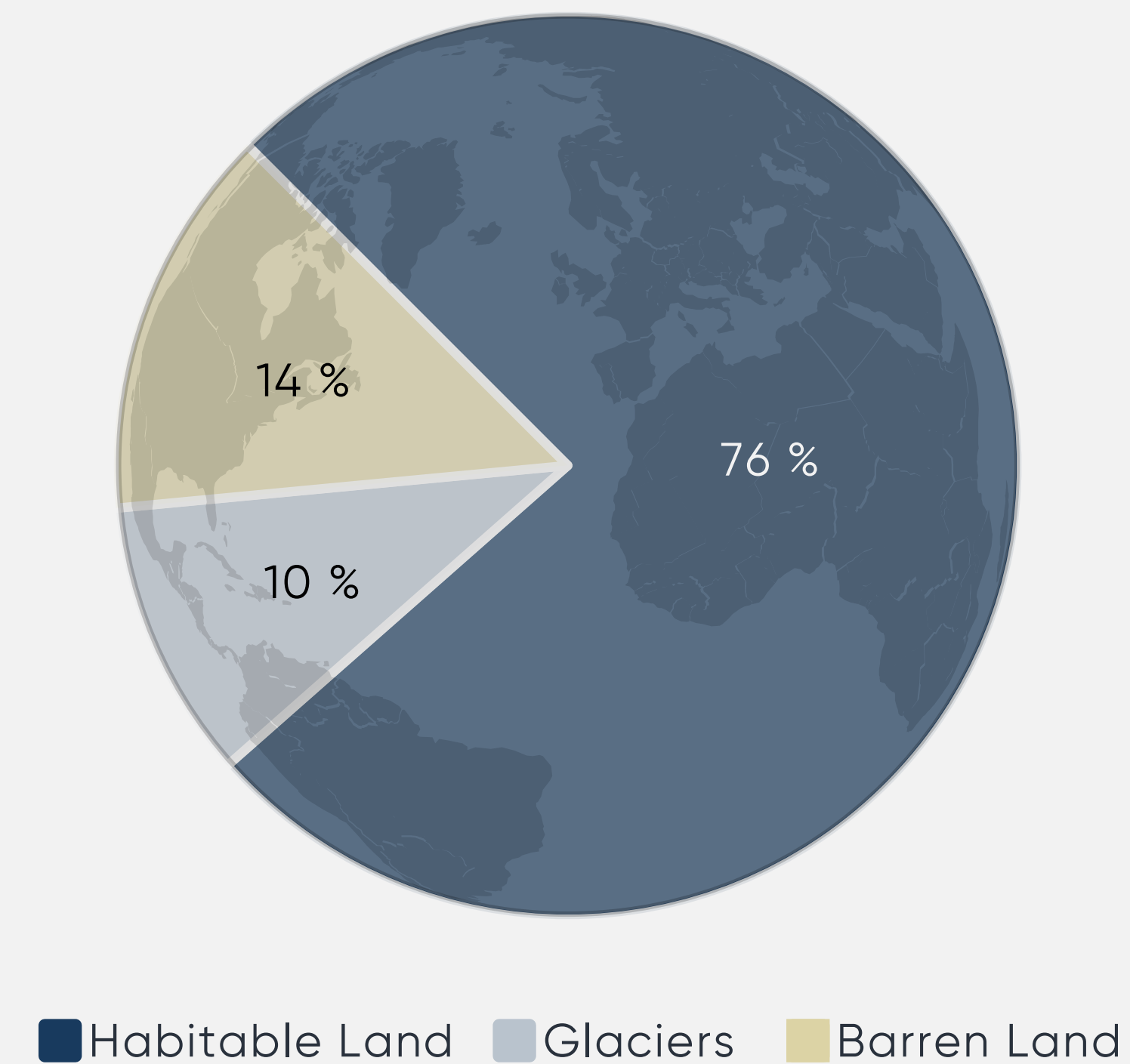
- Often perceived as sustainable country
- 4 times the allowed maximum emissions
- Large portion to transport, food & housing



Average distribution of CO2-e of Danish people

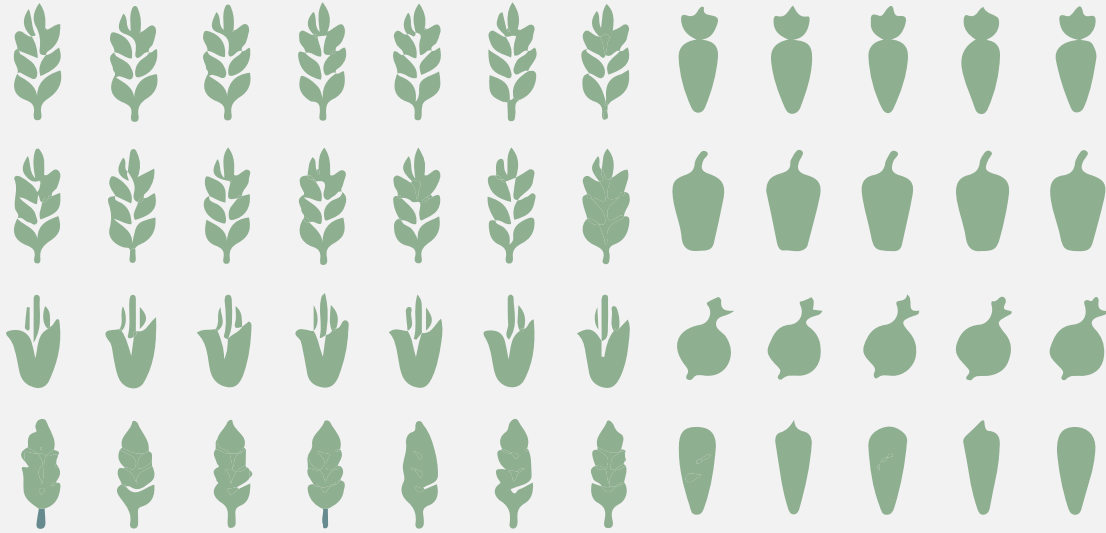
LAND USE OF AGRICULTURE

- 45 % of habital land is agriculture
- Declining in habital land due to climate change



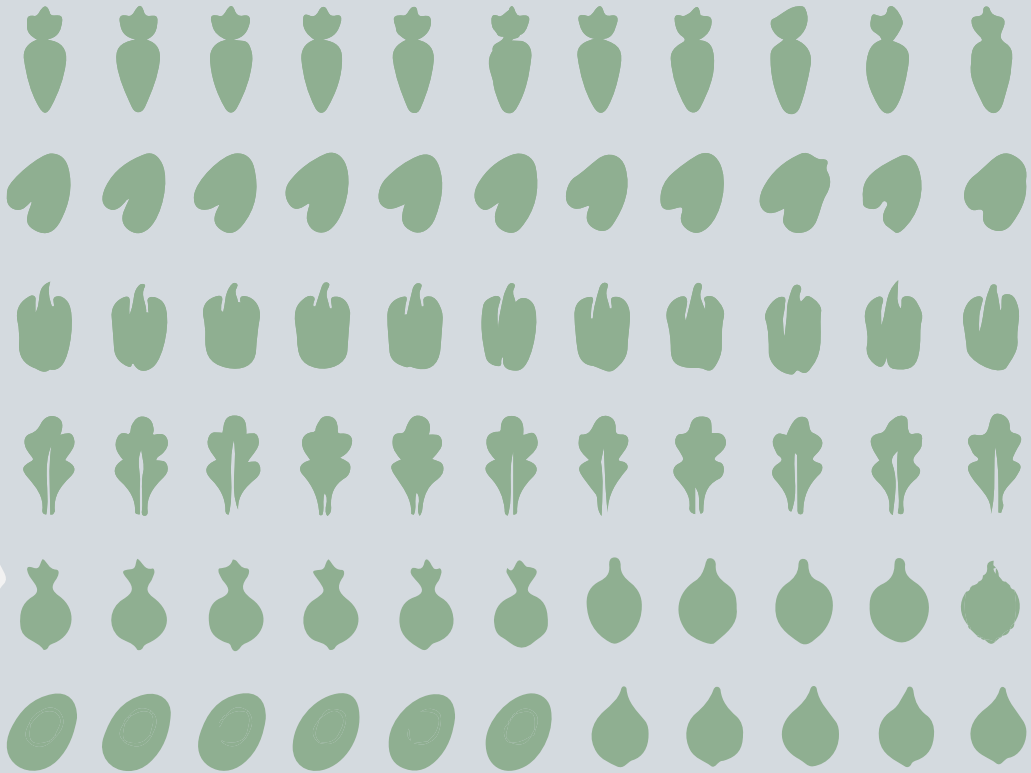
POPULATION & FOOD

2020
7.8 Billion



+50%
food

2050
10 Billion





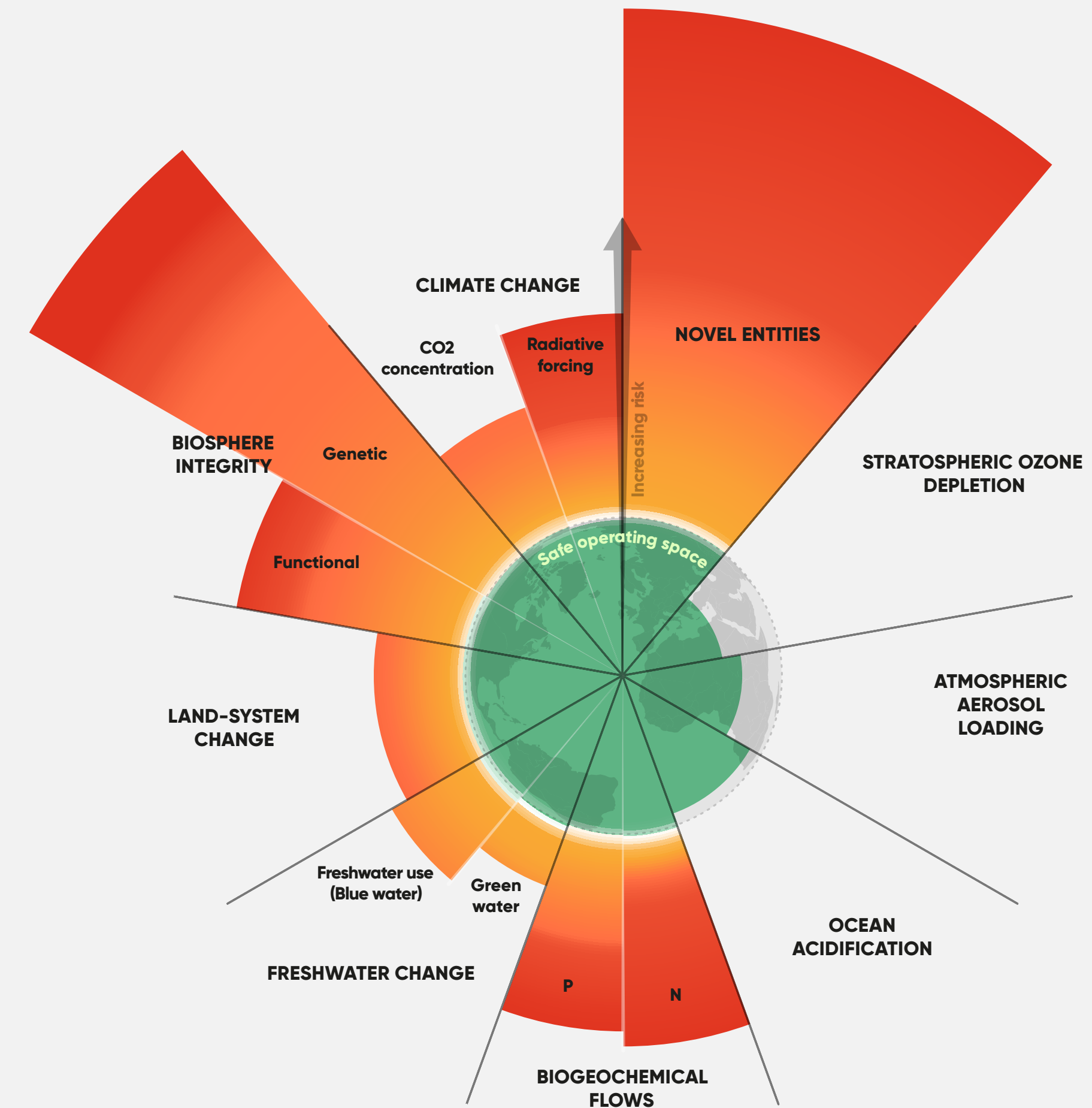
"CONSIDERING **THE IMPACT OF BUILDINGS BEYOND THEIR OUTLINE** IS THE FIRST STEP TOWARDS A SUSTAINABLE ARCHITECTURE. THE SELECTION AND USE OF A DEVELOPMENT SITE AFFECT A NUMBER OF SUSTAINABILITY ISSUES, INCLUDING **LAND USE**, THE CONSERVATION OF **NATURAL ECOLOGIES, FLORA & FAUNA**, AND THE PROVISION OF **NATURAL SPACES TO ENHANCE HUMAN WELL-BEING.**"

(PAOLA SASSI, 2006)

PROBLEM STATEMENT

Architectural practices mainly focus on **carbon budgets**, but a **holistic sustainable** approach should be **common practice**.

- 9 planetary boundaries
- 6 transgressed since 2023 model-update
 - Climate change
 - Biosphere integrity
 - Land-system change
 - Freshwater change
 - Biogeochemical flows
 - Novel entities



Azote for Stockholm Resilience Centre, based on analysis in Richardson et al 2023

RESEARCH.

RESEARCH QUESTIONS

*"How can an **eco-conscious** public condenser be designed to encourage **pro-environmental behavior** among its users?"*

*"How can **holistic sustainability** be defined in **architectural practice**?"*

*"How can the **9 planetary boundaries** model influence **architectural design-methods**?"*

*"Which **architectural design-methods** can **influence behavior** amongst its users?"*

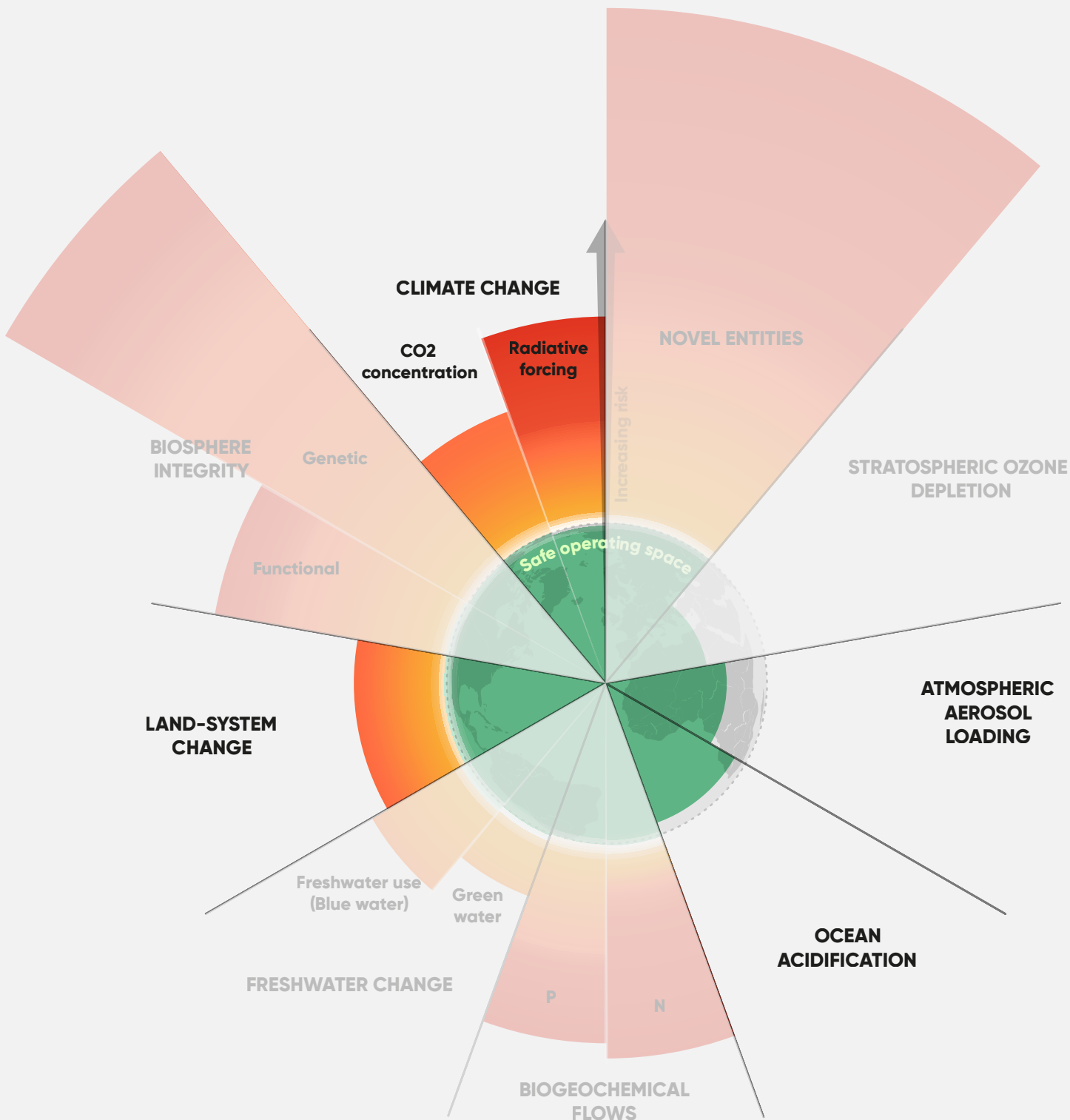
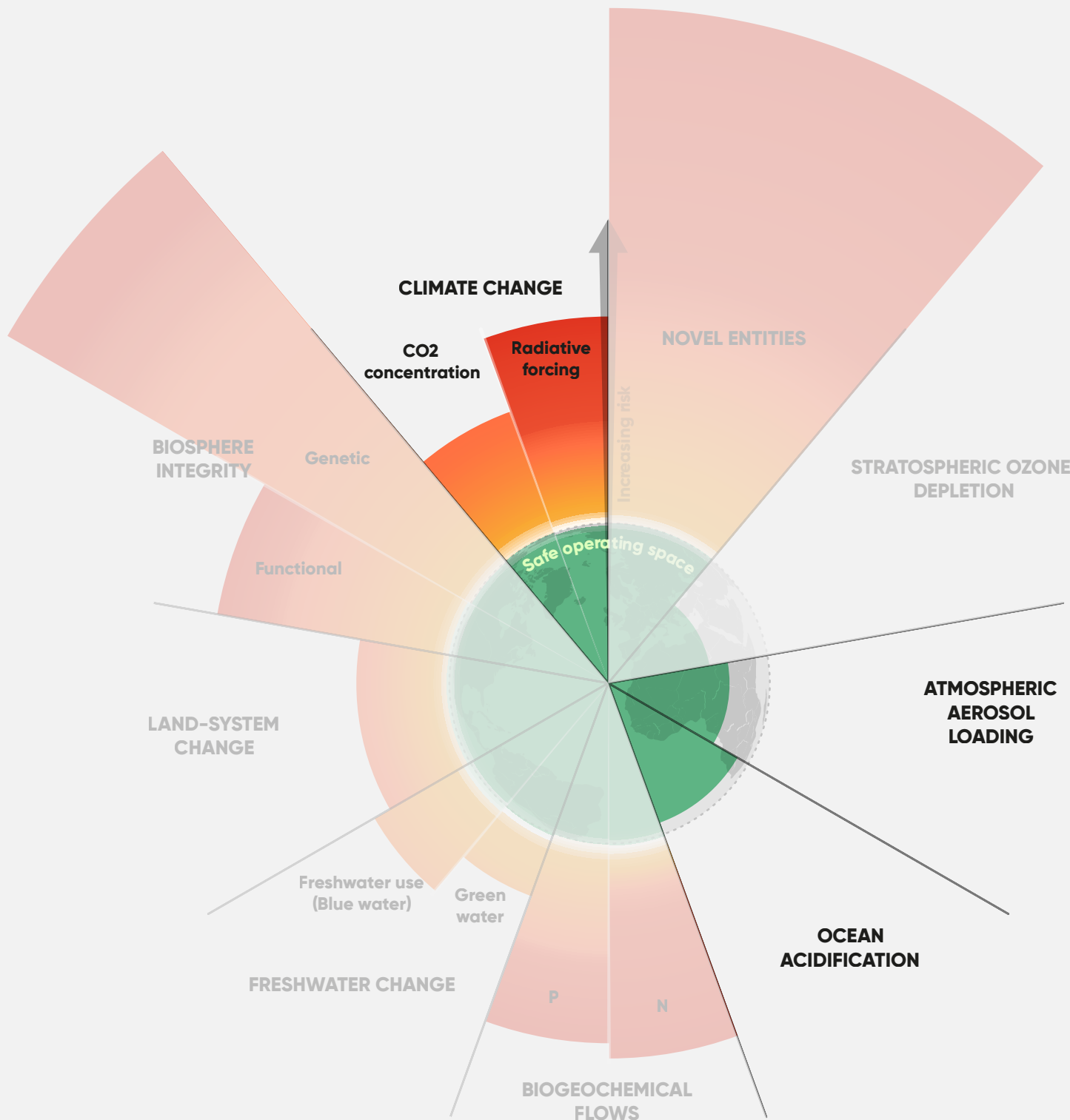
TRANSLATING TOWARDS ARCHITECTURE



- Aerosols emissions
- Lower greenhouse gases
- CO₂ affects ocean acidification



- Aerosols emissions
- Lower greenhouse gases
- CO₂ affects ocean acidification
- Energy infrastructure impact land systems



TRANSLATING TOWARDS ARCHITECTURE

Circular Economy

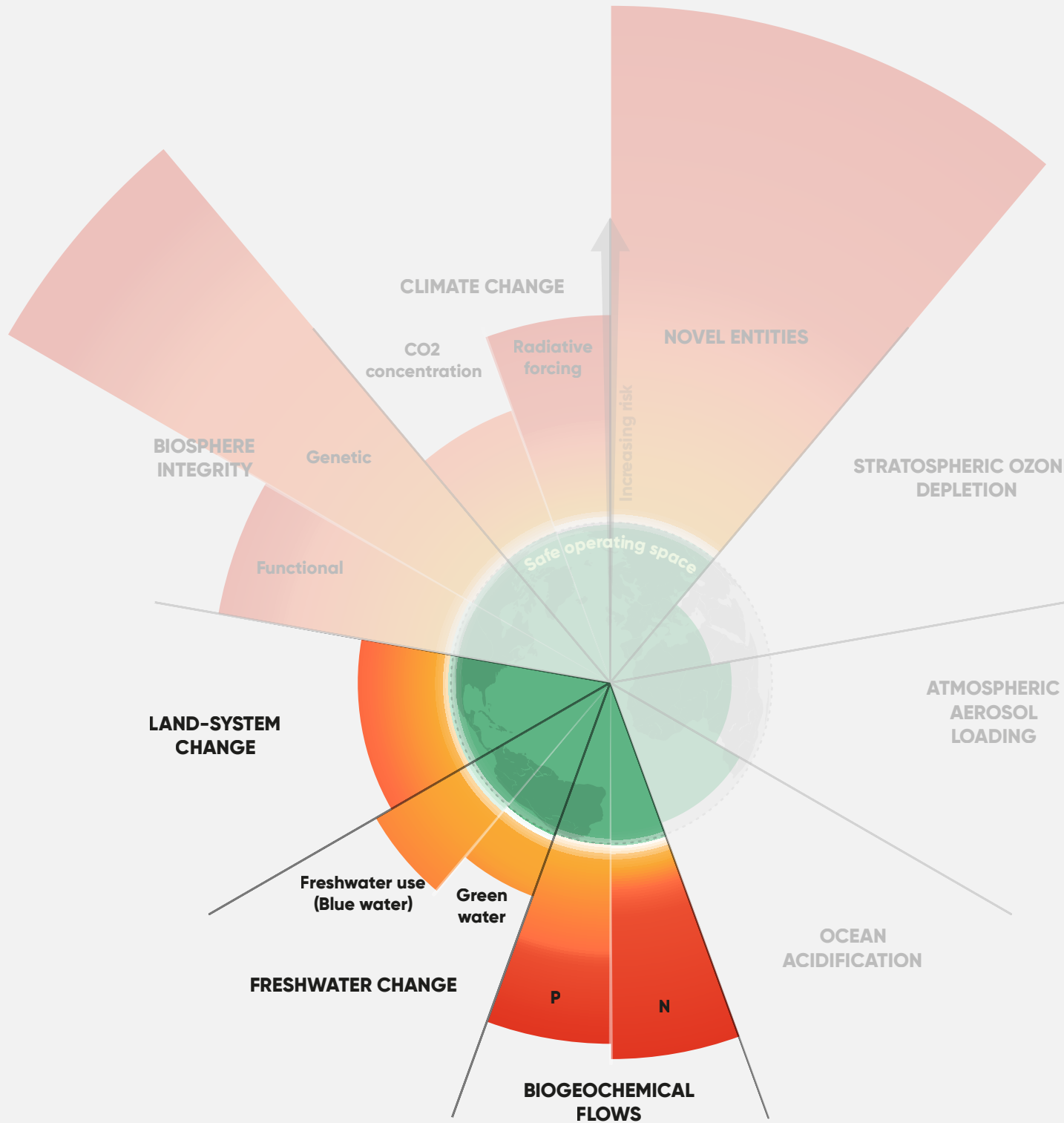
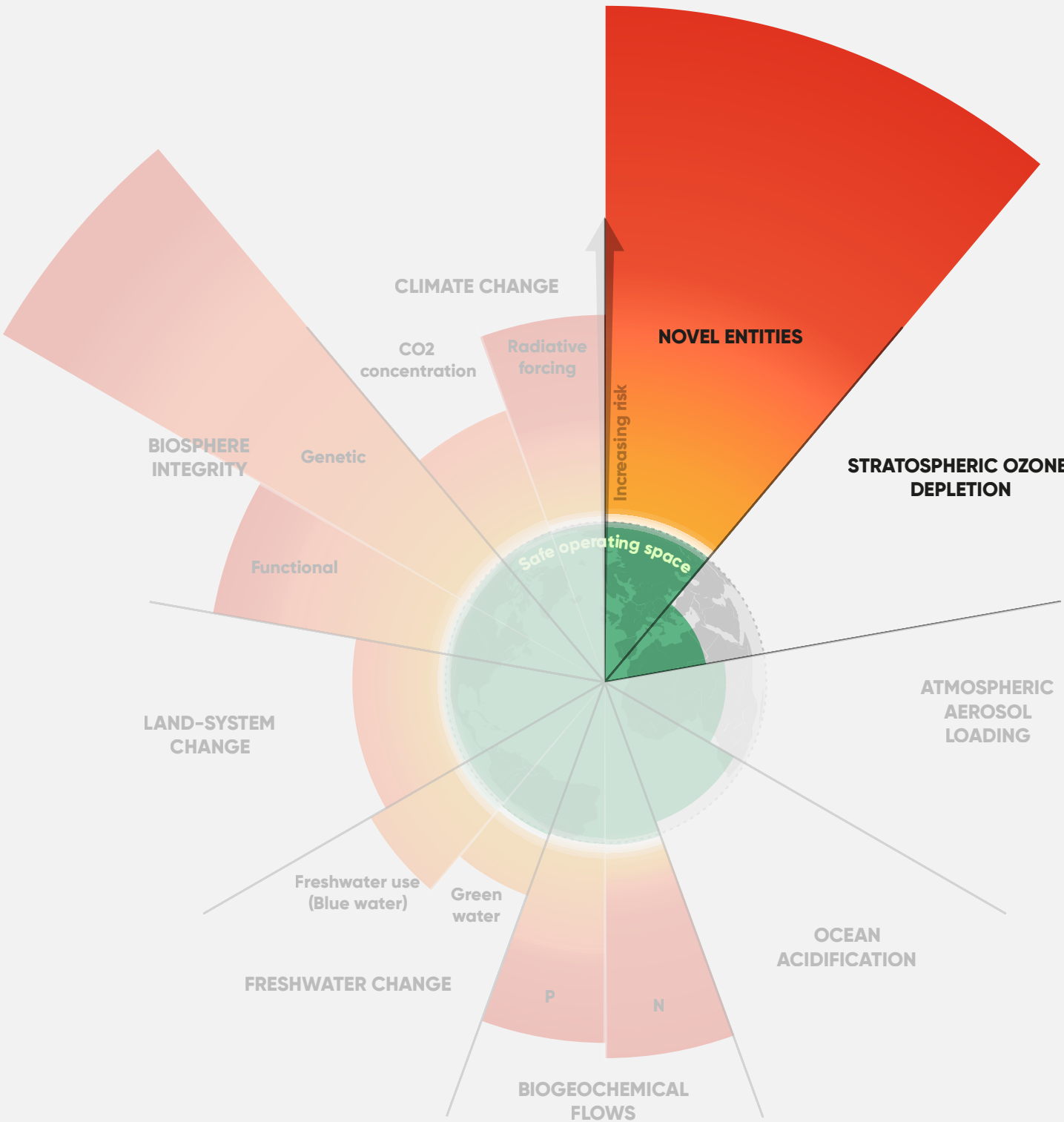


- Regulate novel entities
- Material passports prevented ozone depletion

Sustainable Functionality



- Prevents land-system change
- Functions regulate water flow
- Regulation of biogeochemical flows

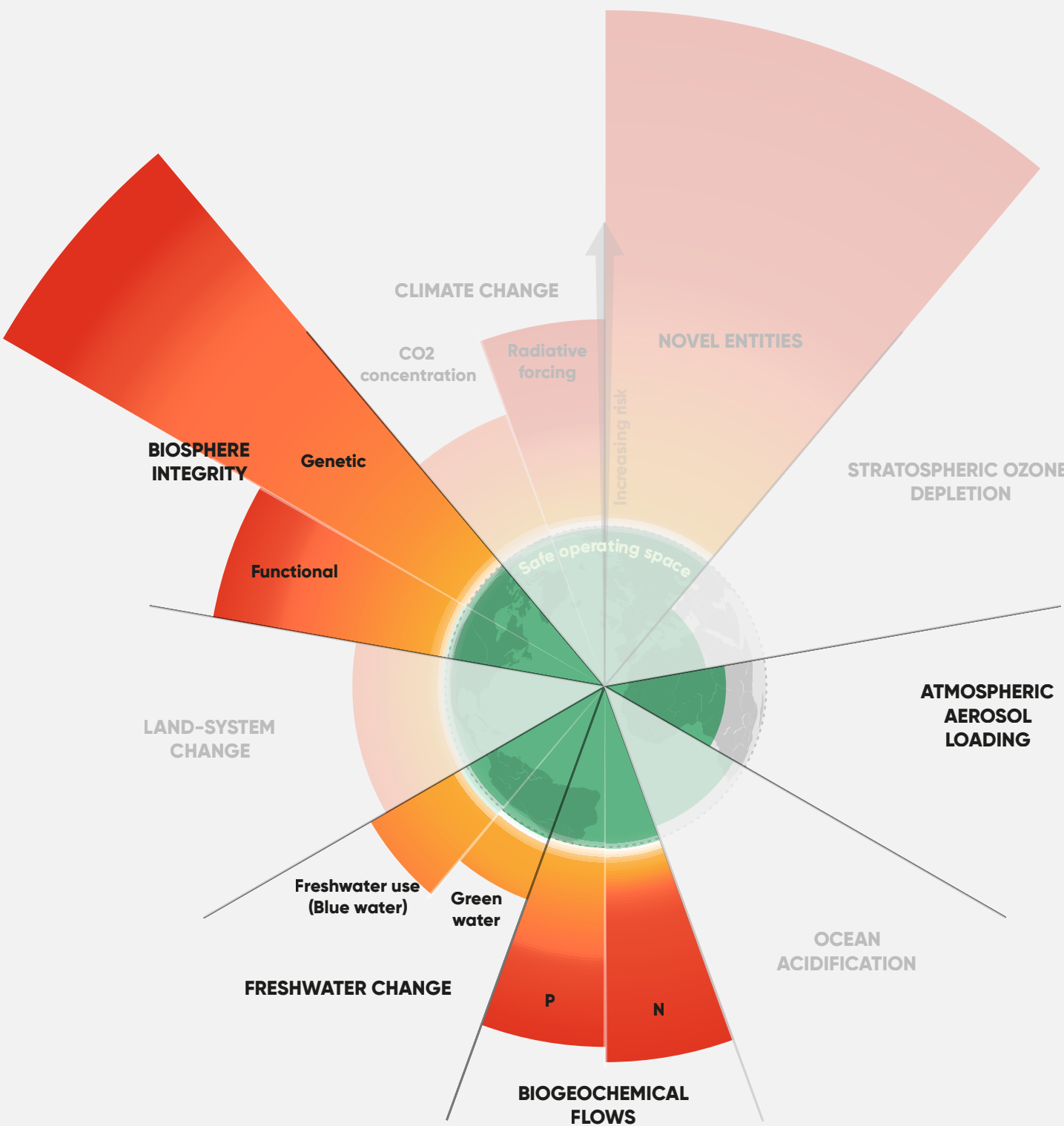


TRANSLATING TOWARDS ARCHITECTURE



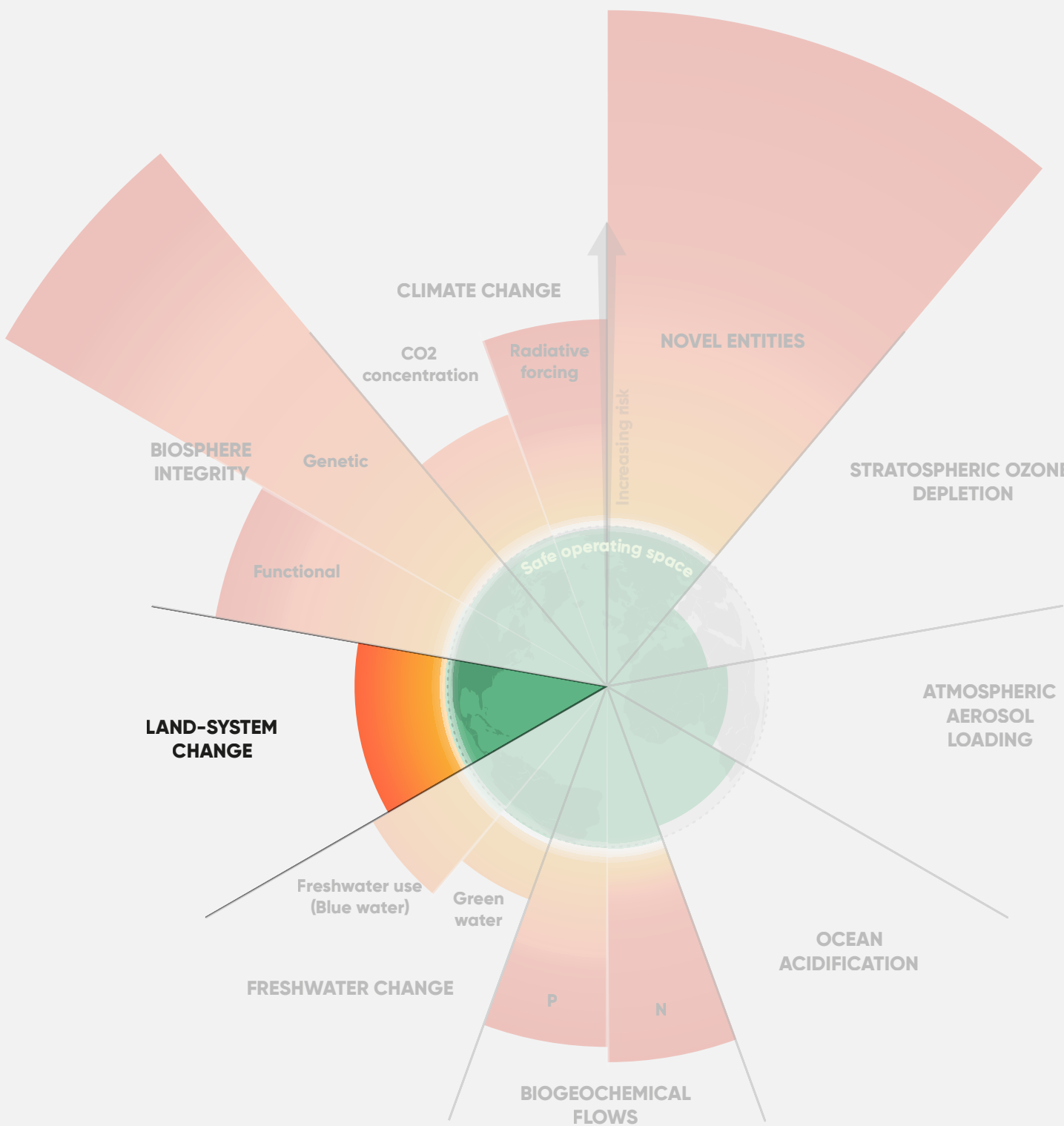
Nature
Integration

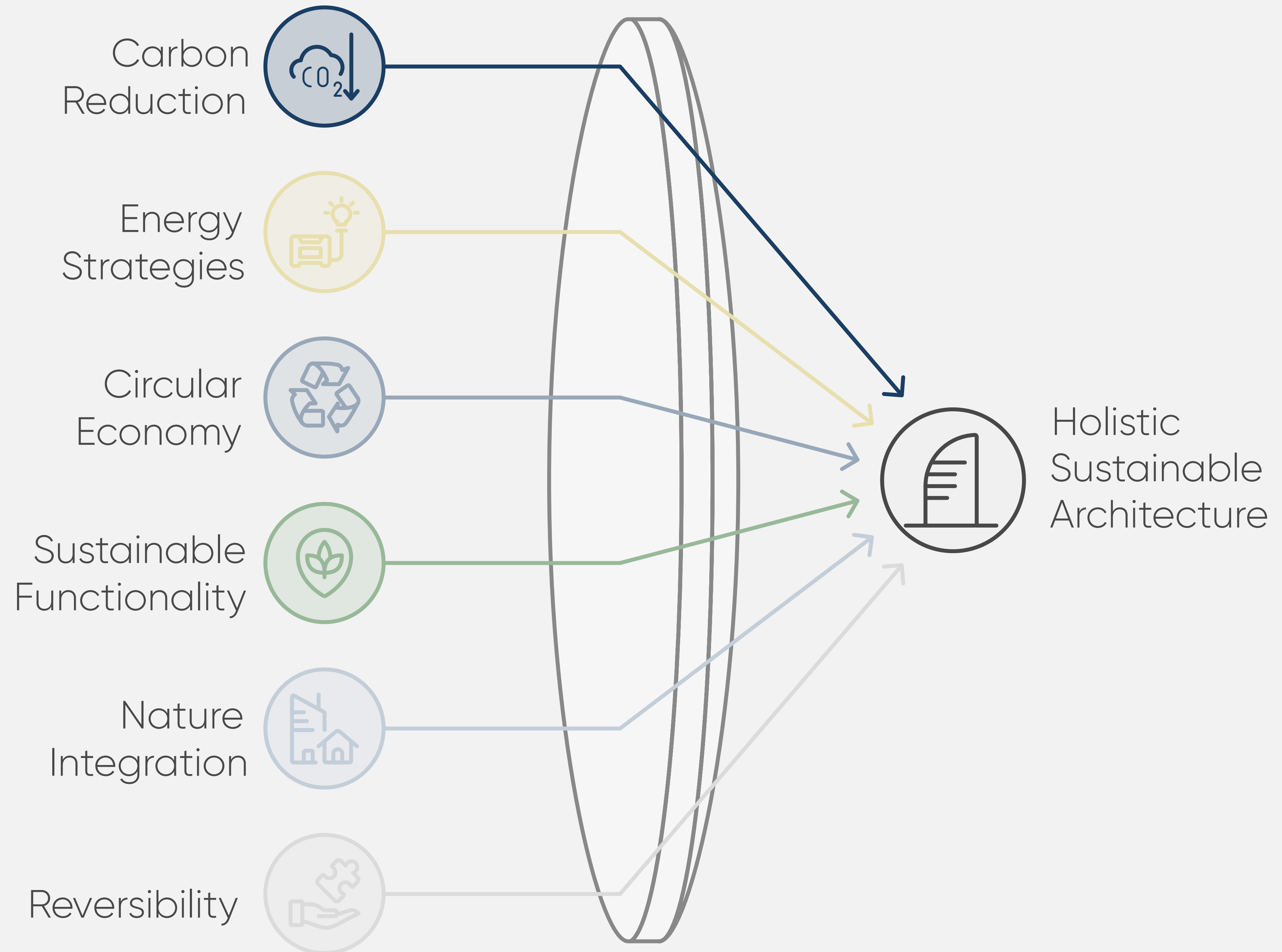
- Biosphere integrity
- Regulates water- & nutrient flows
- Cleans aerosols

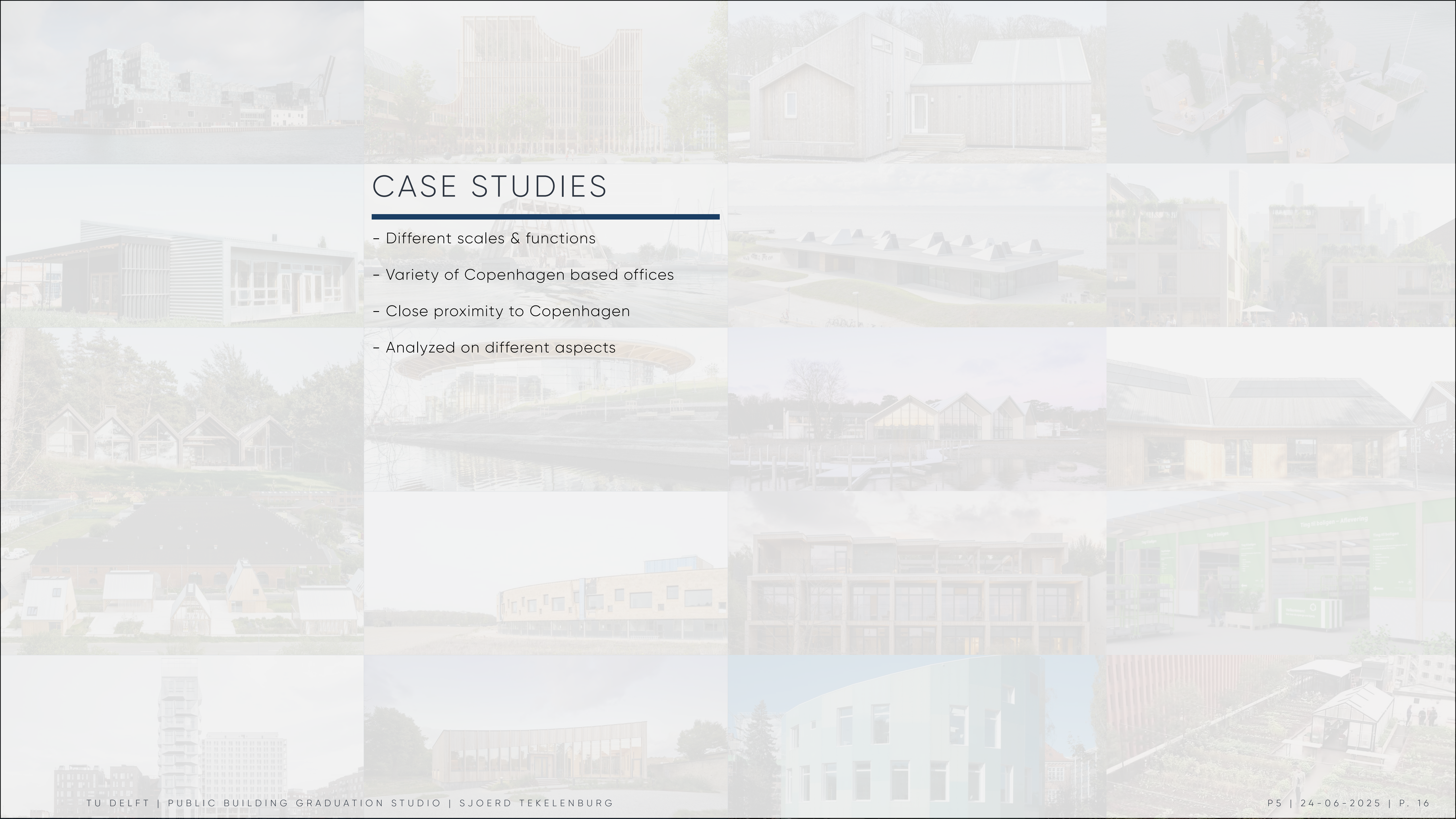


Reversibility

- Reversal of ecological harms

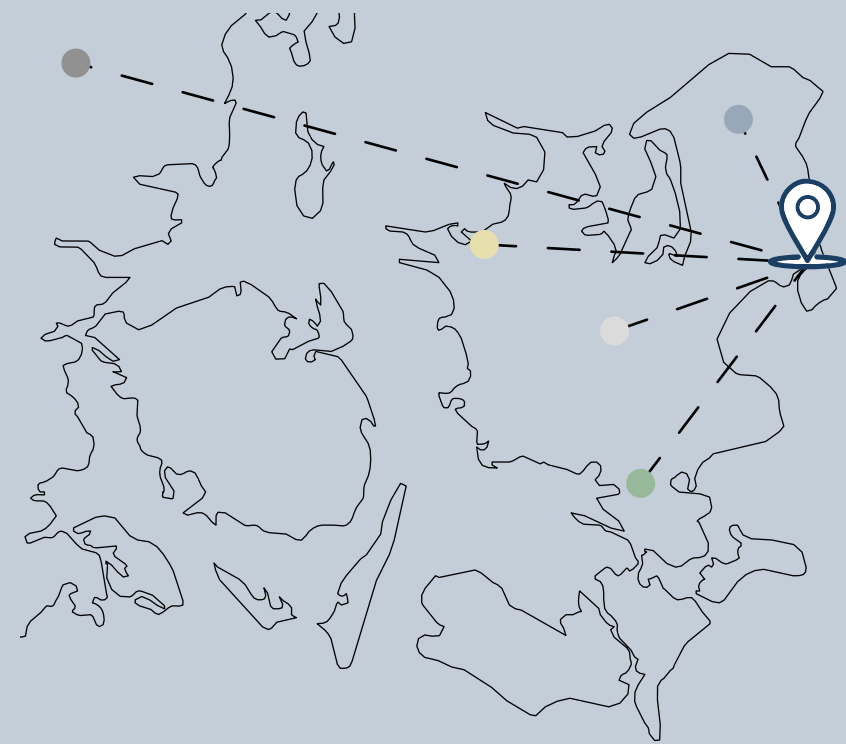




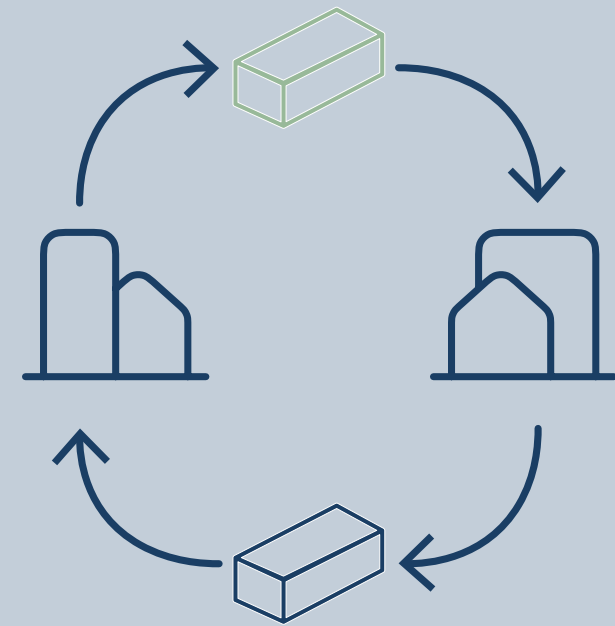


CASE STUDIES

- Different scales & functions
- Variety of Copenhagen based offices
- Close proximity to Copenhagen
- Analyzed on different aspects



Local materials

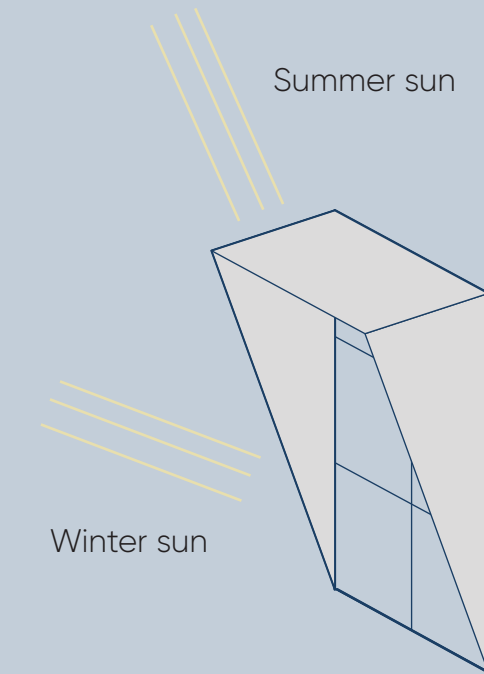
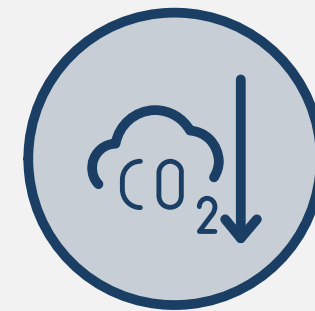


Reusing existing materials

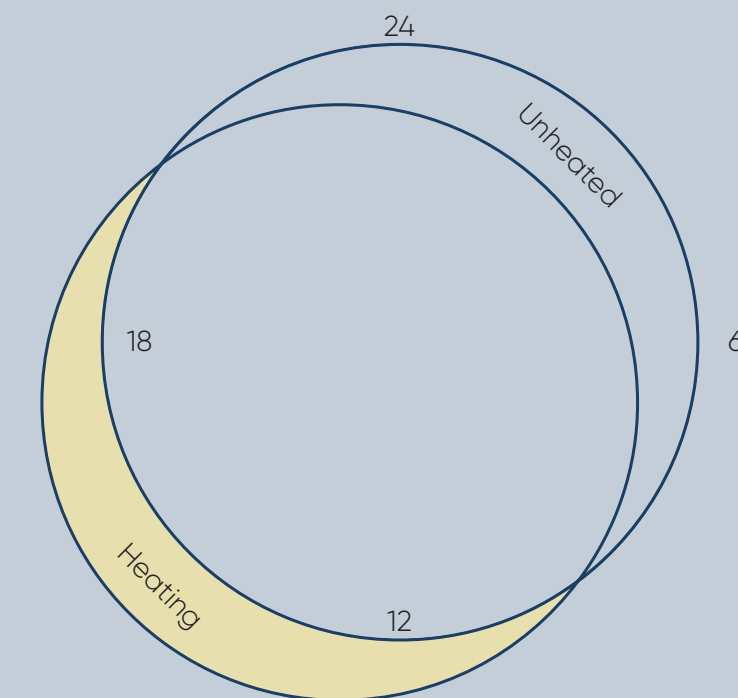


Biobased materials

Carbon
Reduction



Passive design principles



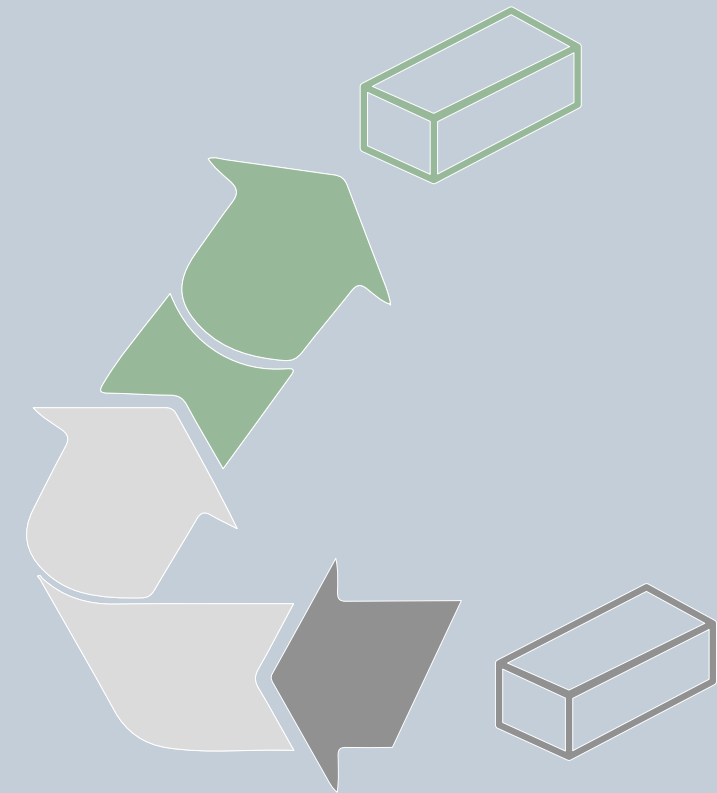
Reducing energy consumption



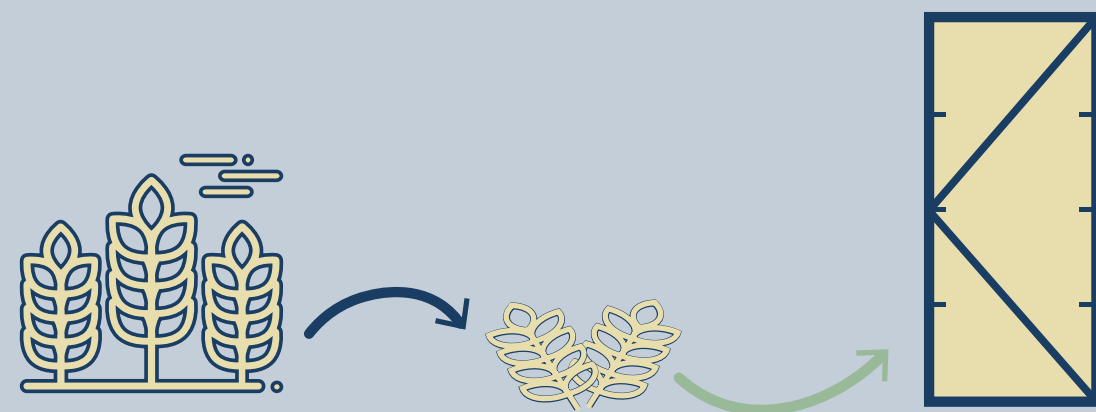
Local energy production

Energy
Strategies





Upcycling existing materials

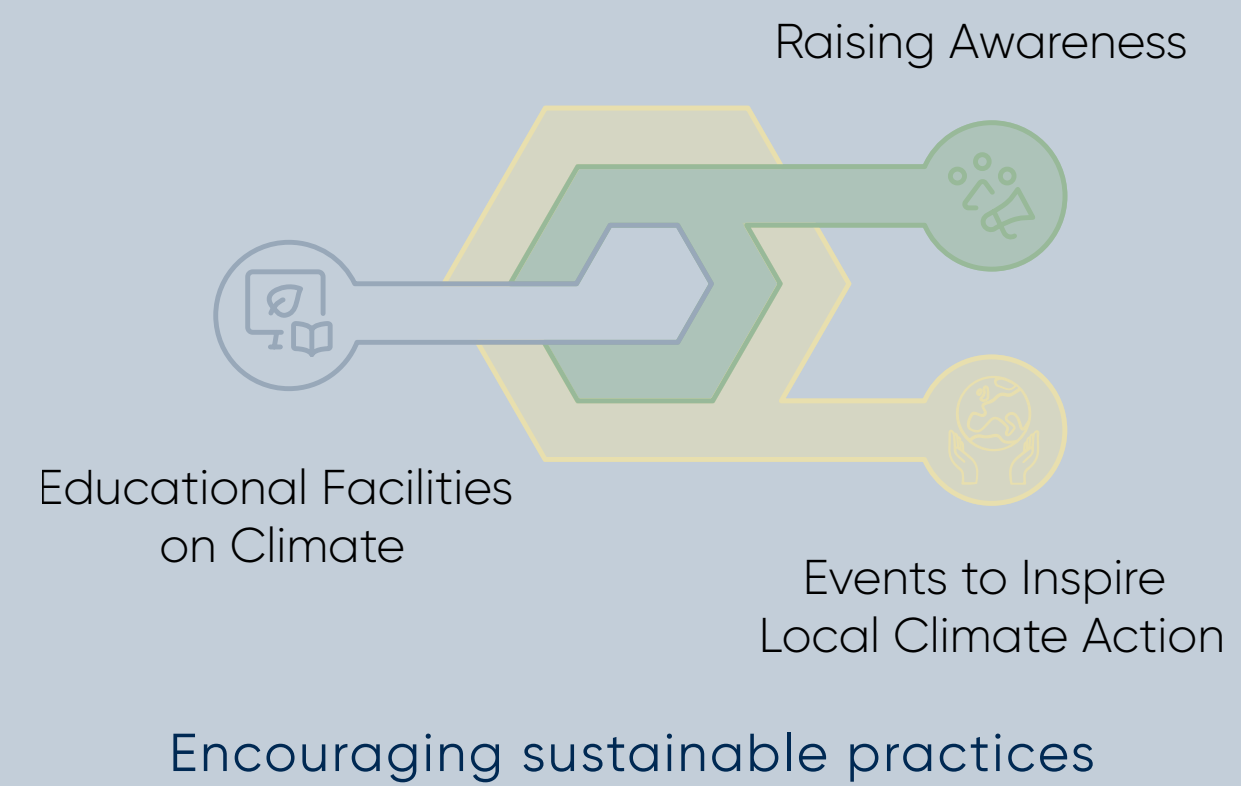


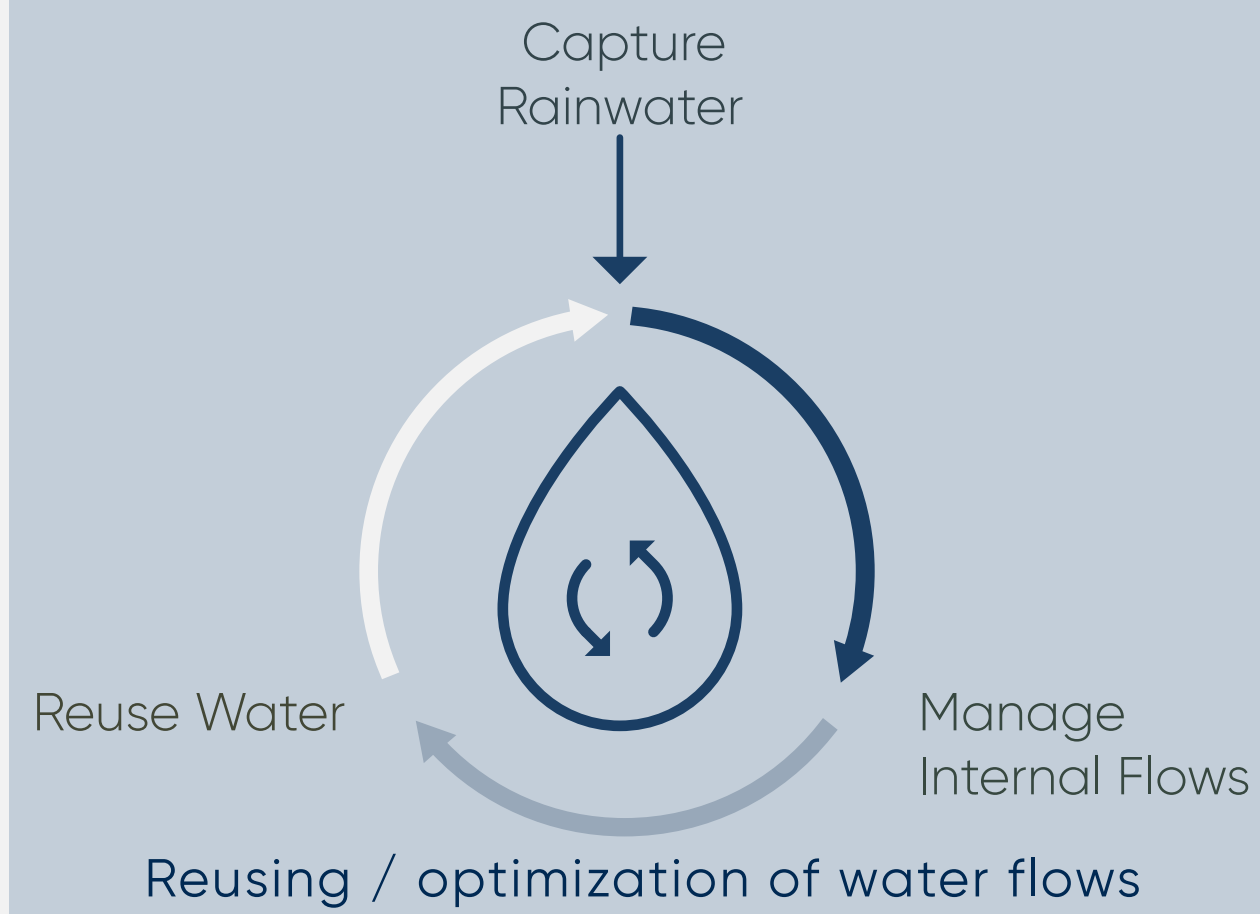
Incorporating waste streams

Circular
Economy



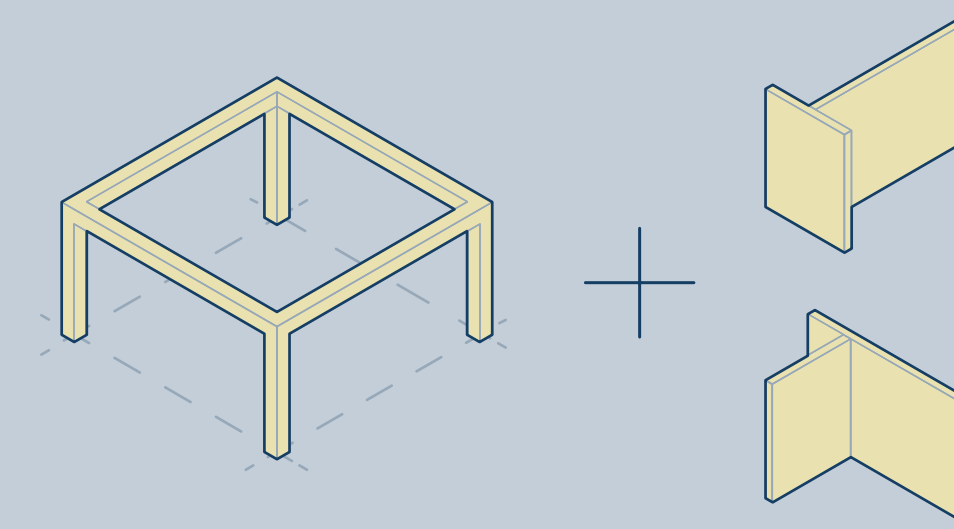
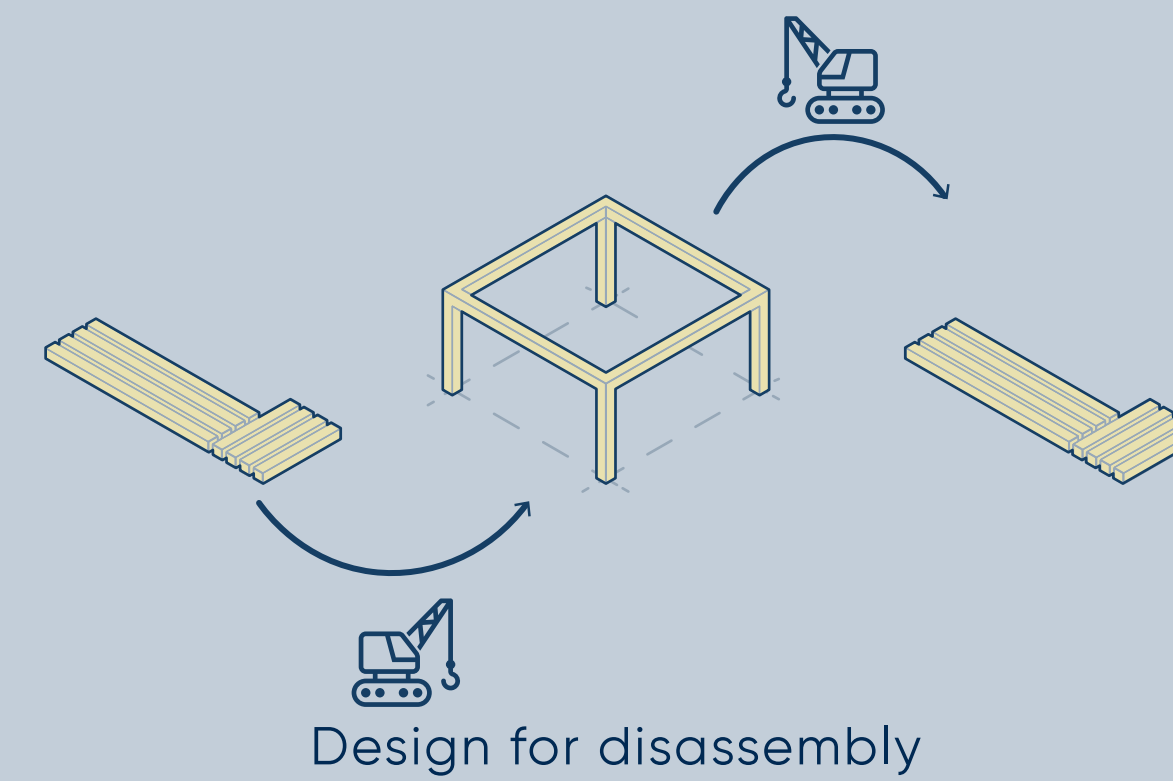
Sustainable
Functionality





building integrated with biosphere

Nature
Integration



Reversibility



PROTOTYPE.

PROTOTYPE

Movable, thus can create **network** of
pro-sustainable living

Examples

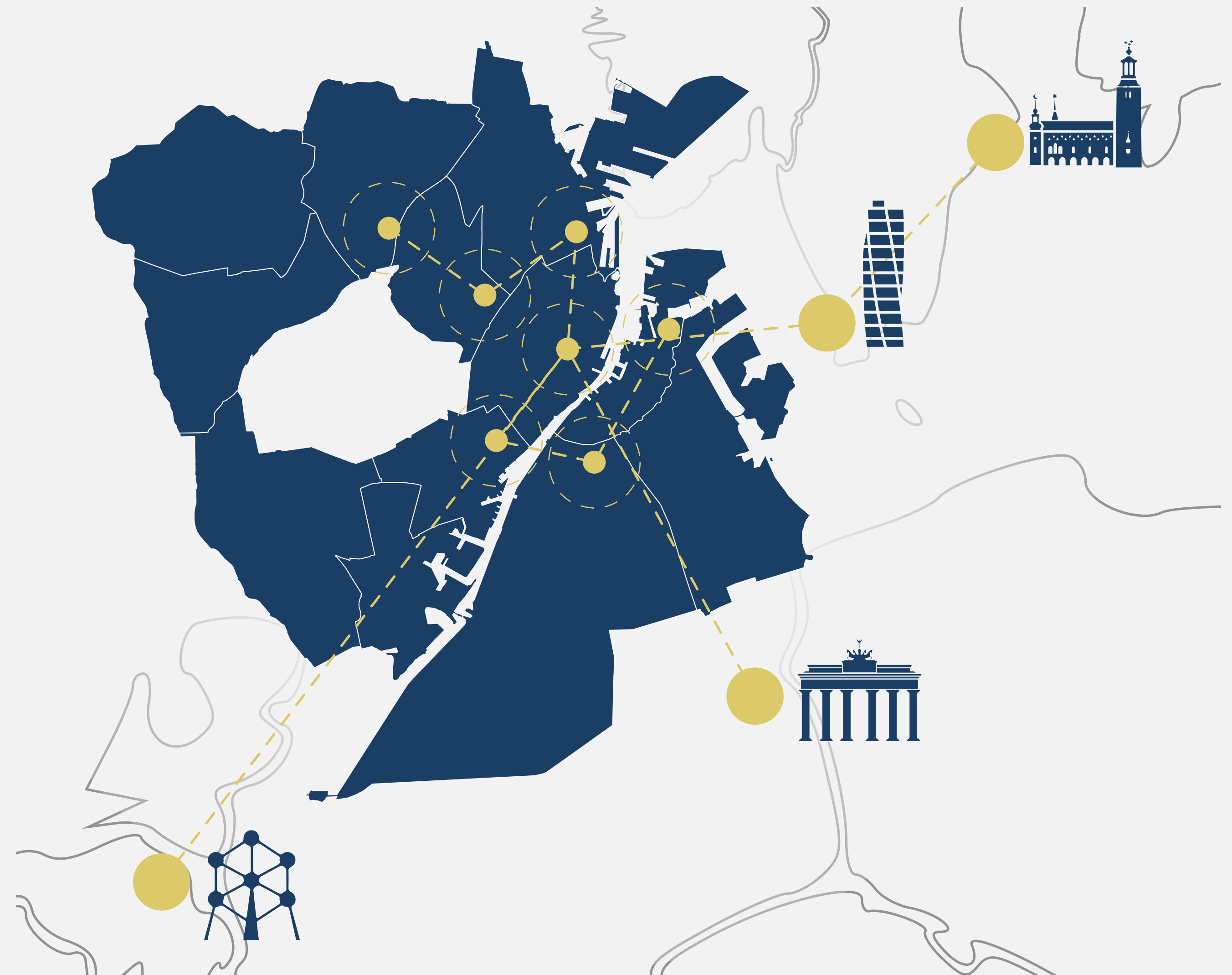
Brussels | Facto Capital European Union

Berlin | Capital of Germany

Malmö | Neighbouring metropole

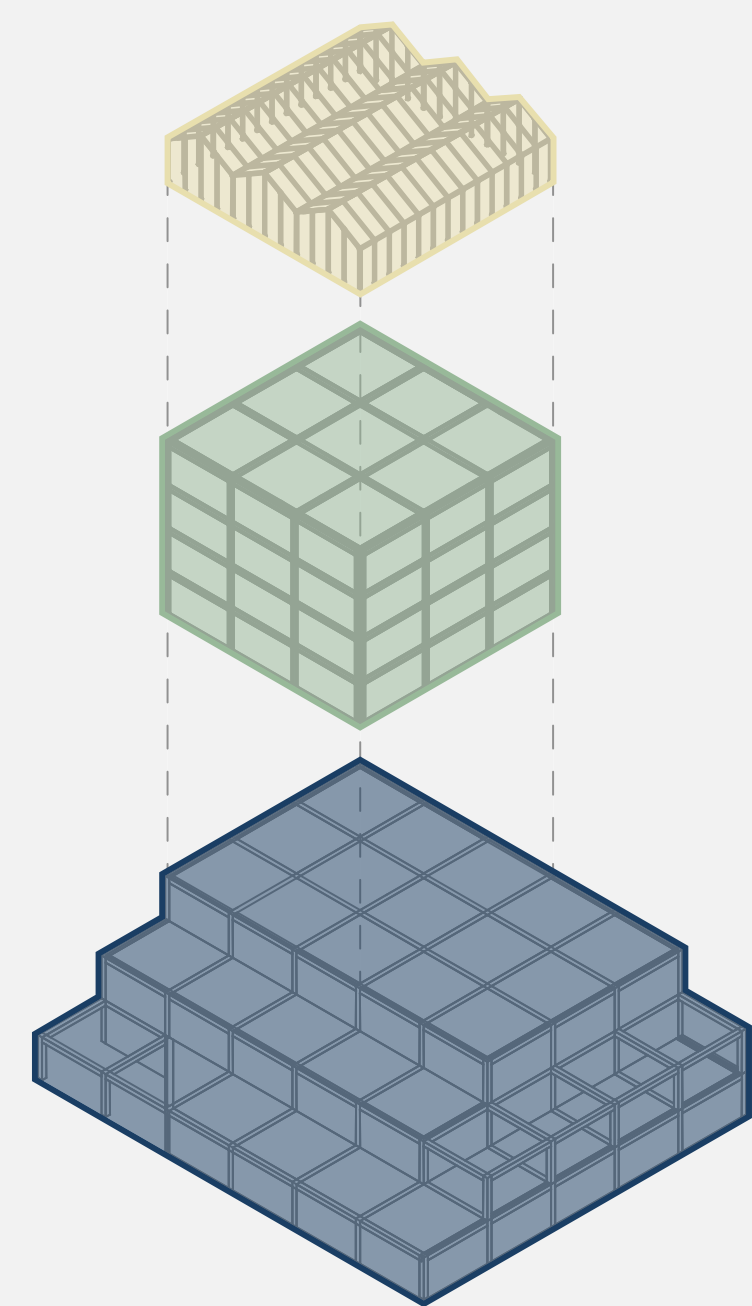
Stockholm | Neighbouring capital

Not only local impact, rather
raising climate awareness

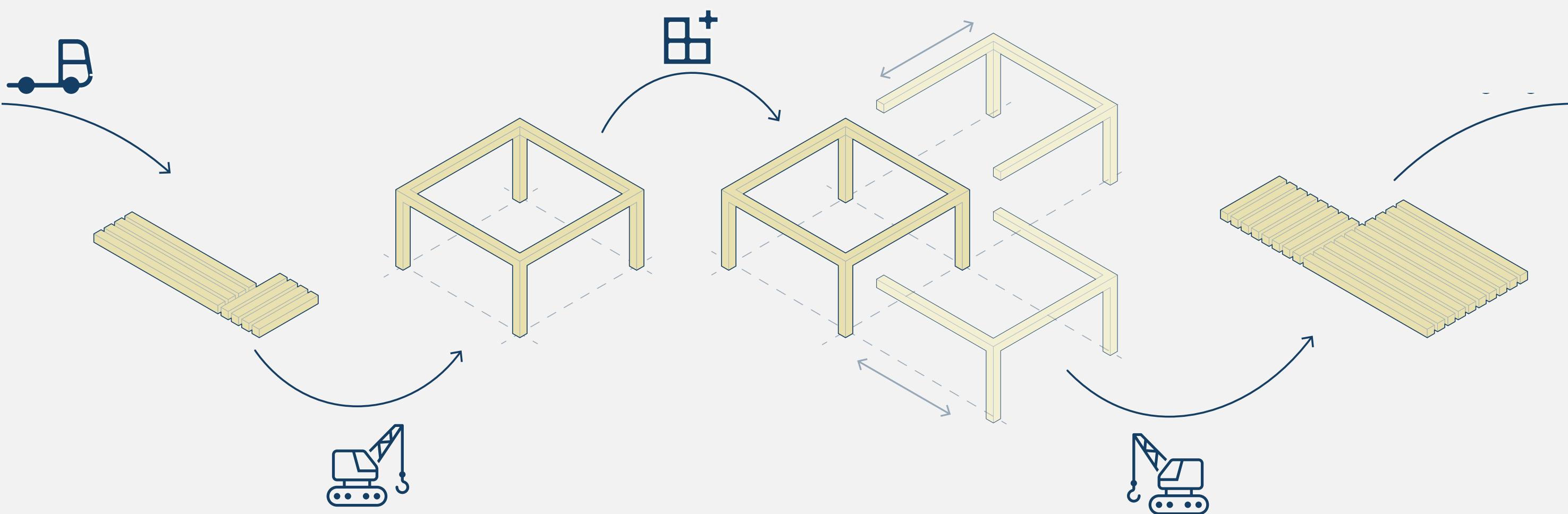


Prototype | Building as tool to raise network of climate awareness

DESIGN POSITIONS

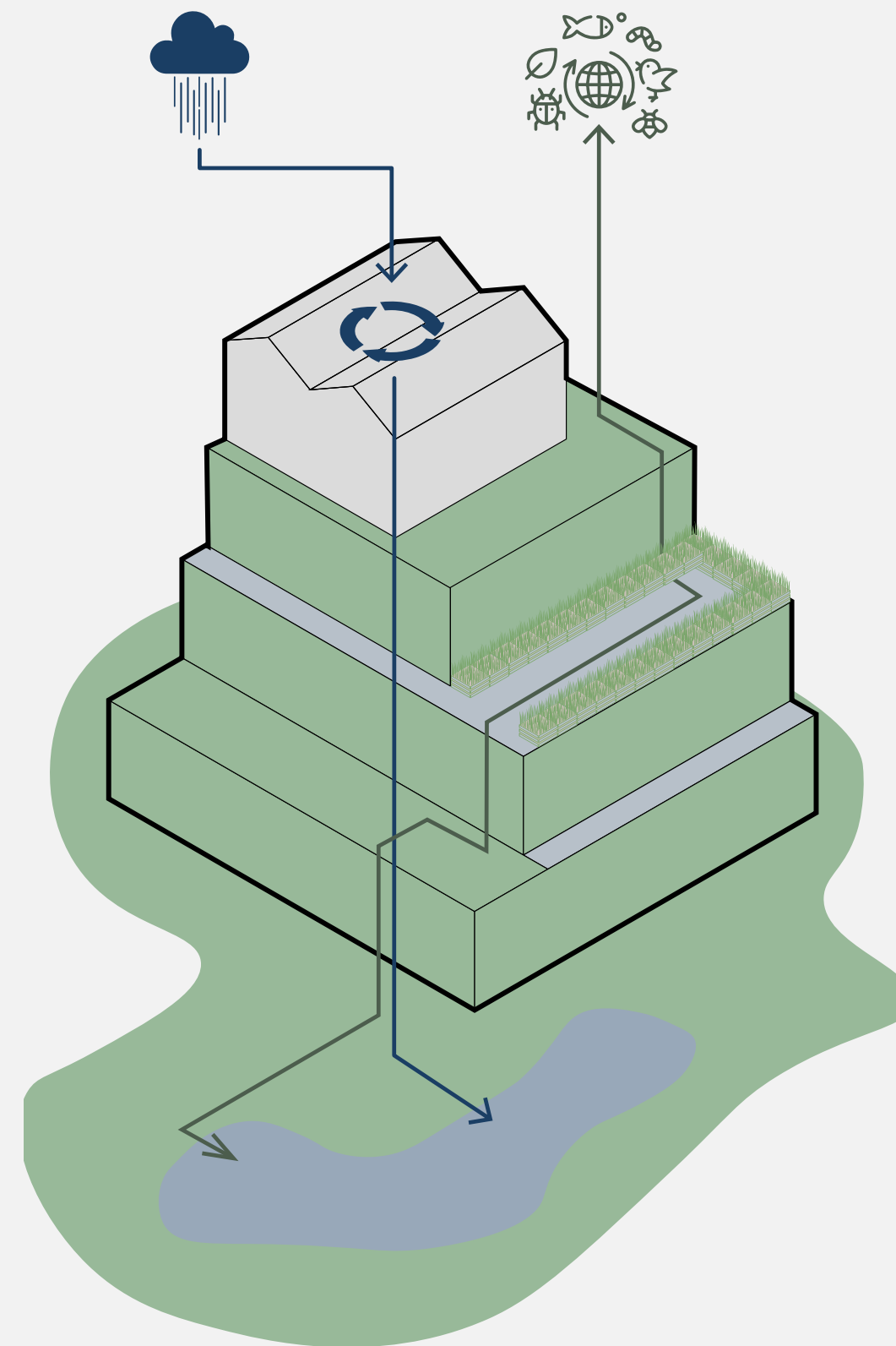


Object is recognizable & sculptural
Creates eco-conscious identity
& promotes participation

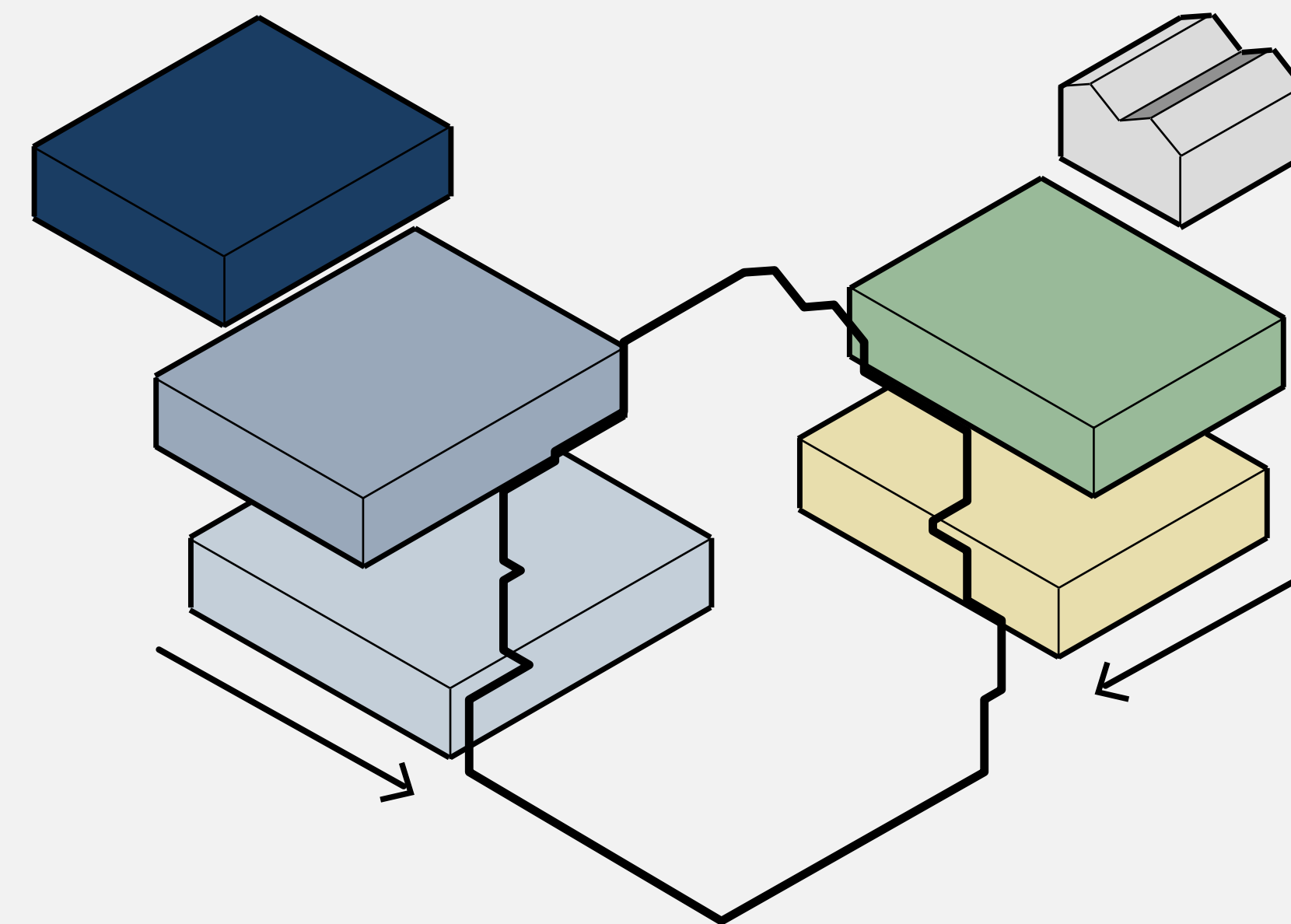


Building is demountable, flexible & expandable
Future land-use change & remountable

DESIGN POSITIONS



Building incorporates ecological architecture
Biosphere integrity & Fresh water change



Plug 'n play functions | Adds to identity & land-use change

FUNCTION GROUPS

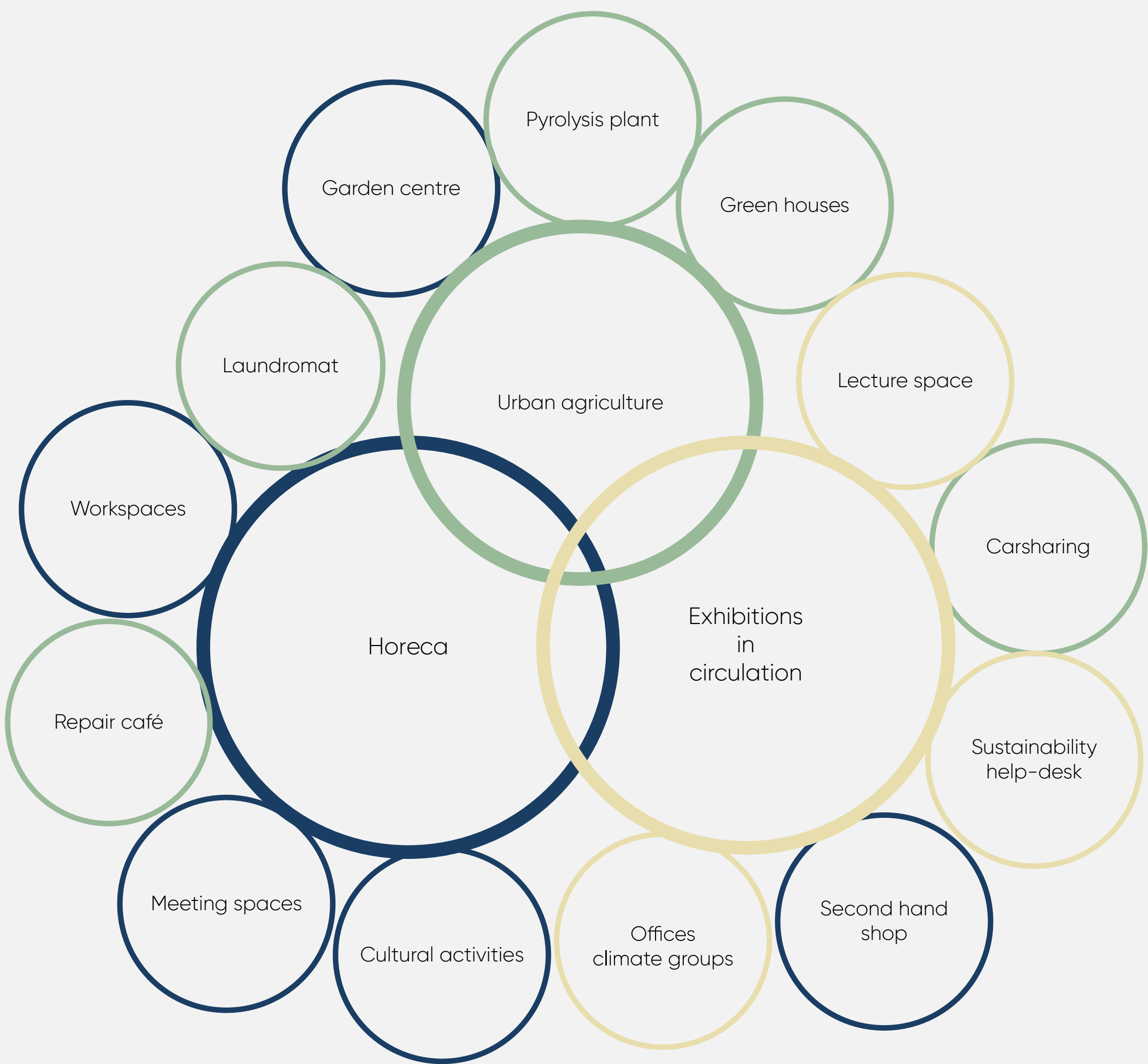
- Functions are chosen accordingly
- Help create strong identity
- Hybridity allows for interaction between functions



Encouraging functions

Sustainable Functions

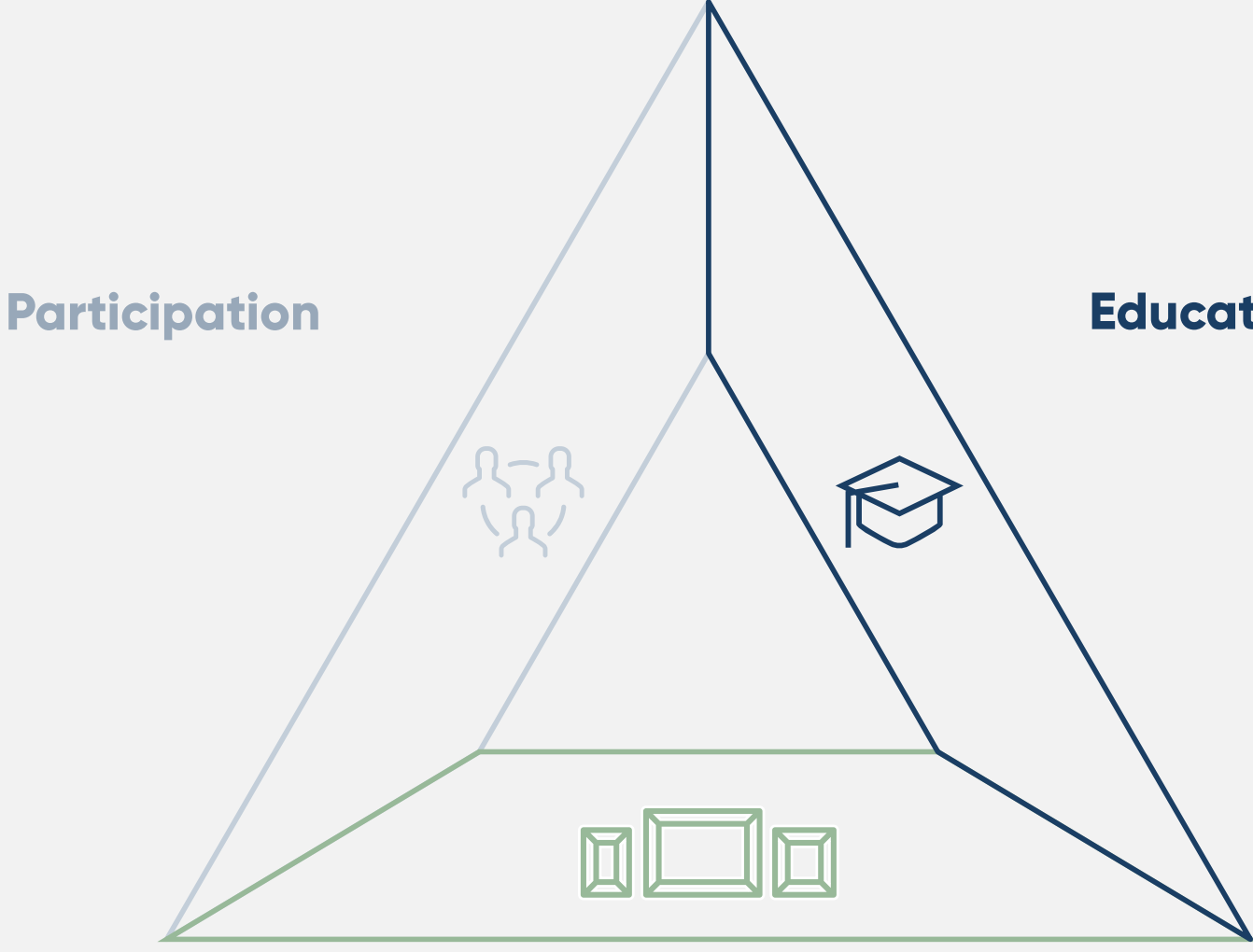
Attractive functions



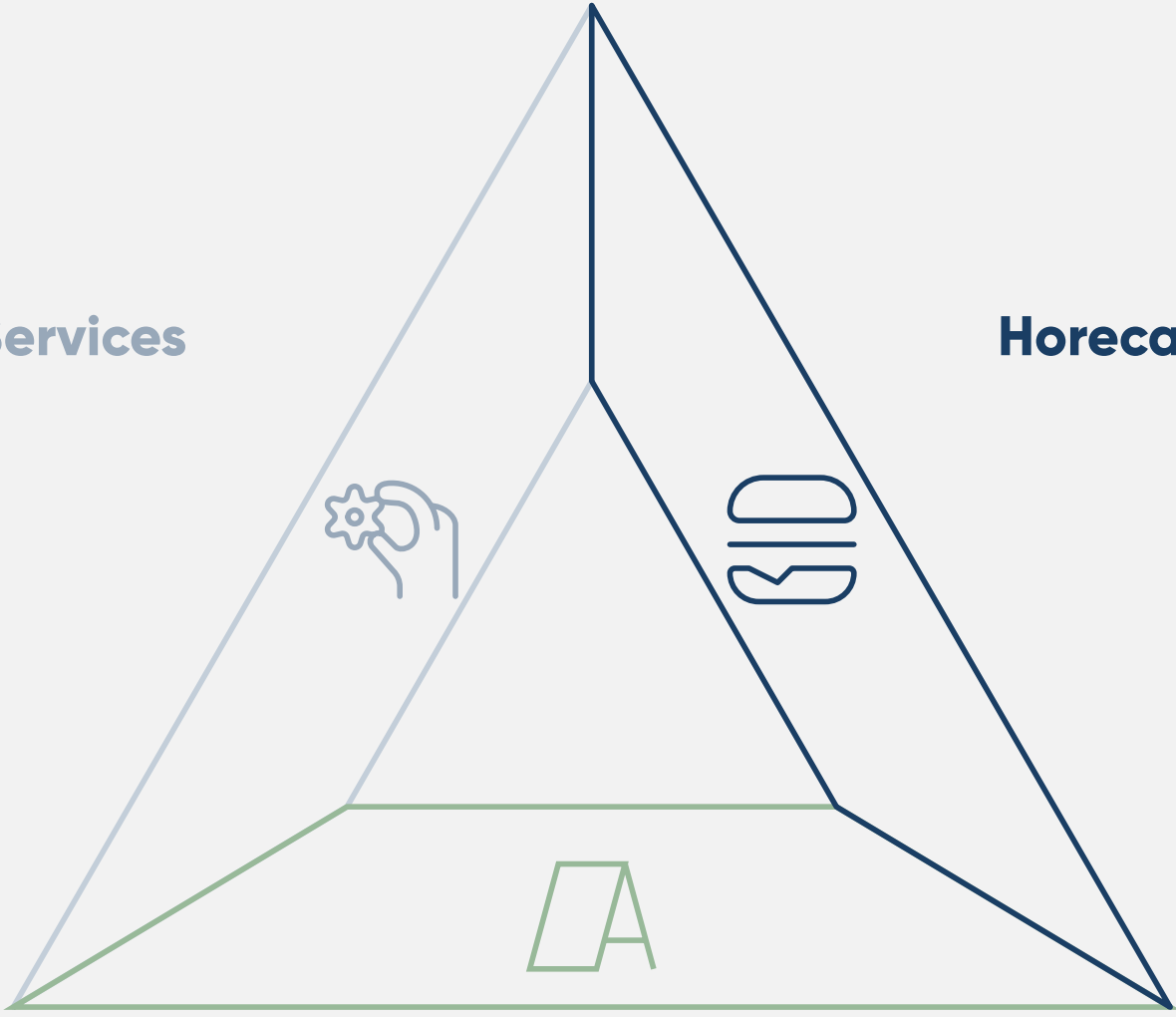
FUNCTIONS



Allowing for sustainable functions



Encouraging sustainable behavior



Attractors

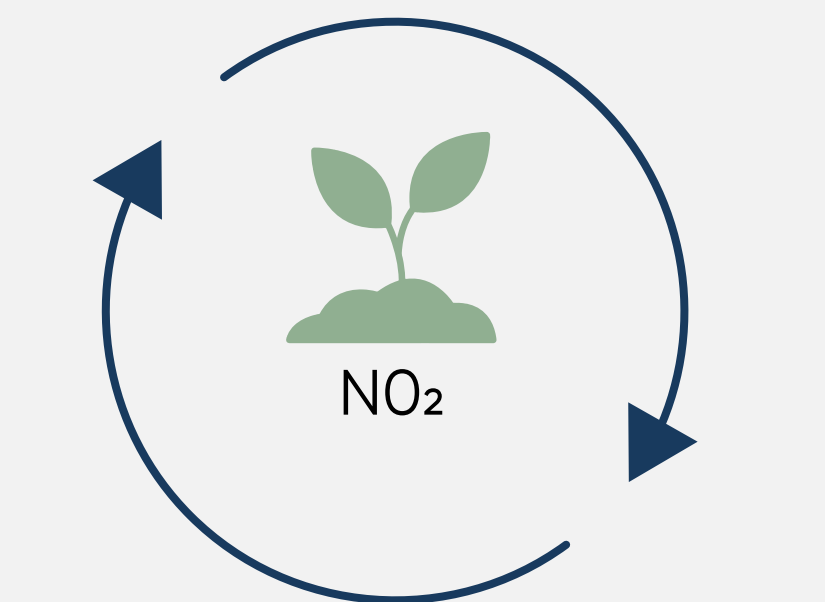
BUILDING INTEGRATED AGRICULTURE

- Usage of hydroponic farming

(plants in nutrient-rich water solutions instead of soil)



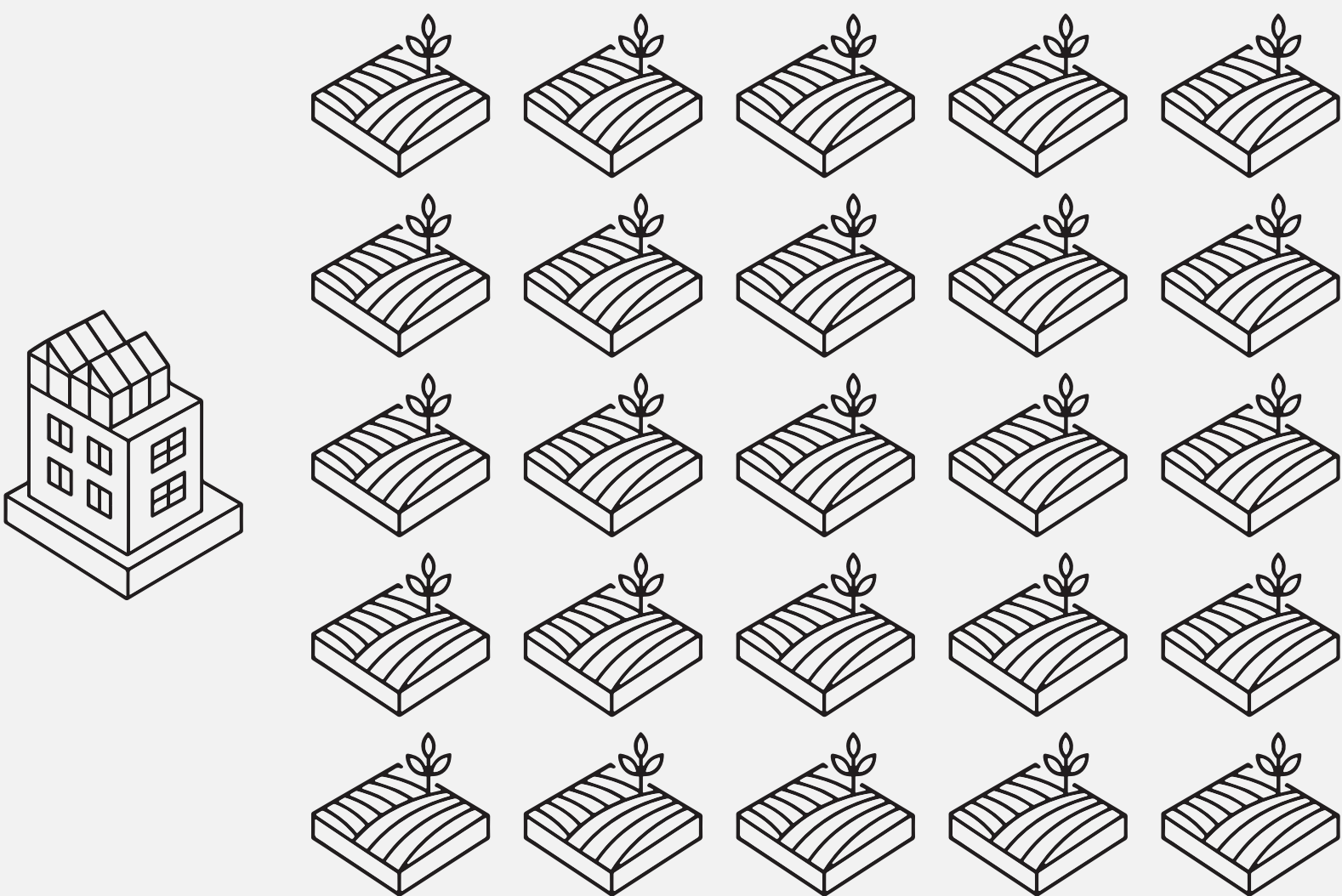
Reducing food mileage
&
Local and resilient agriculture



Closed nutrient flows
prevent nutrient pollution



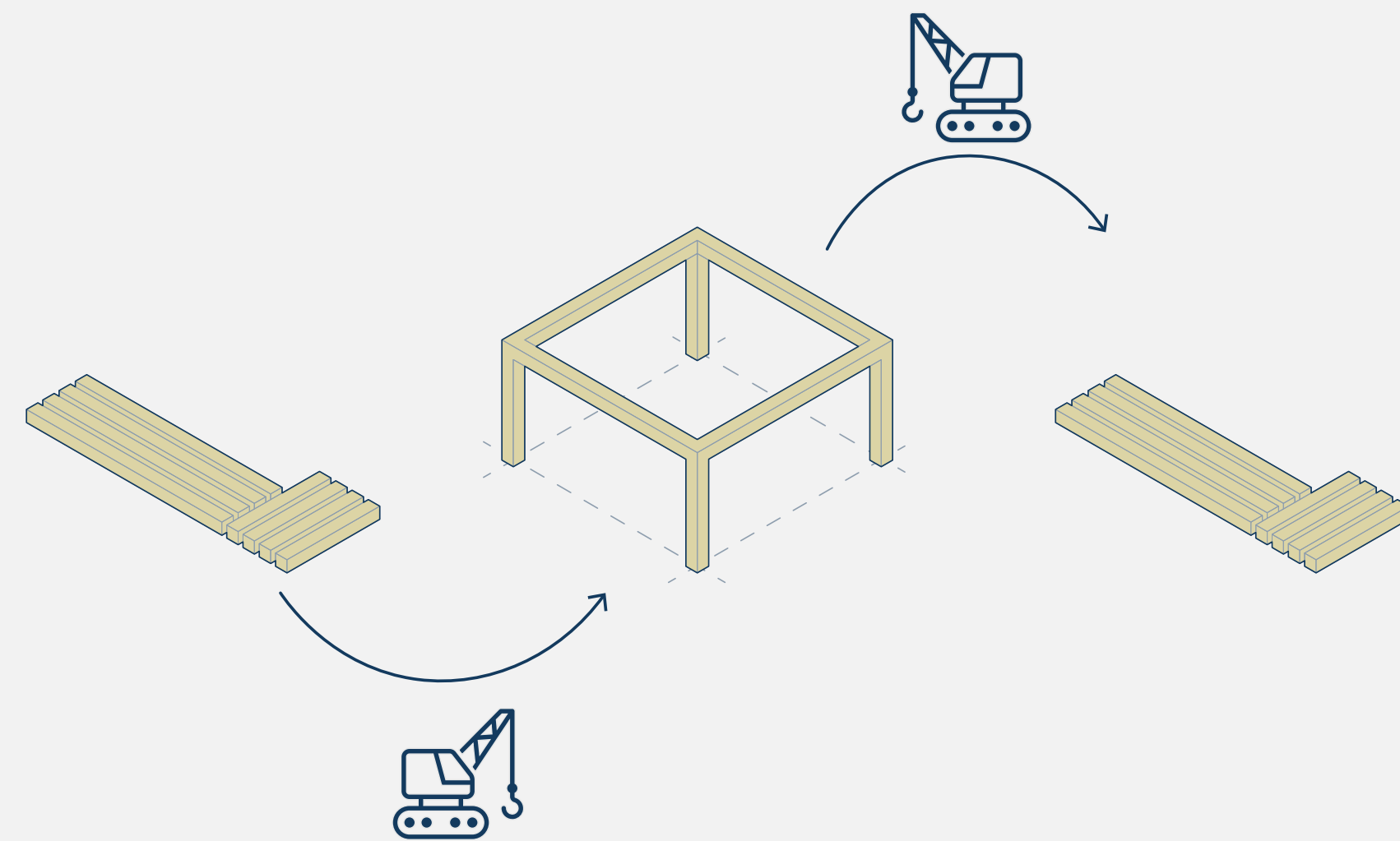
90% Water use reduction



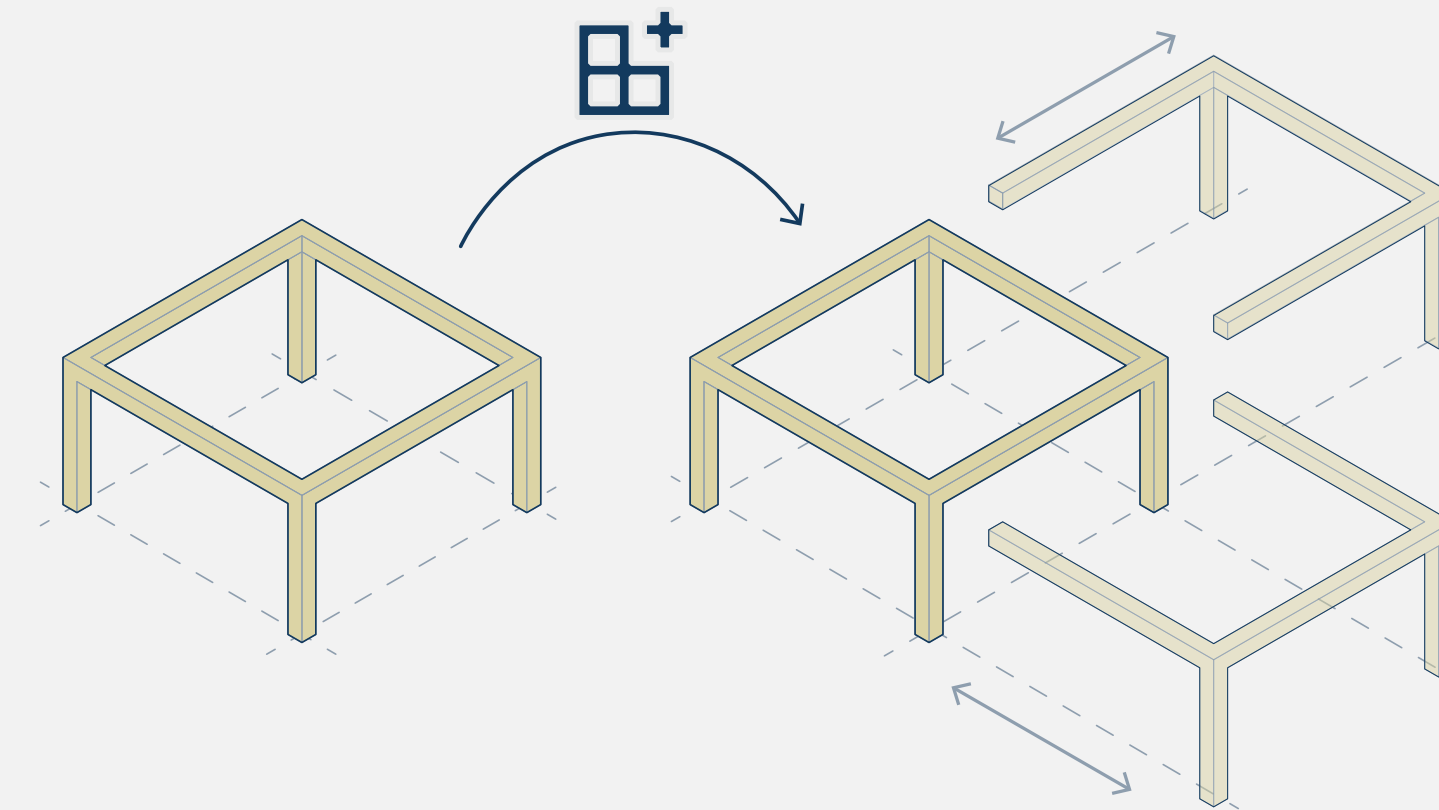
96% reduction of land-use

BUILDING SYSTEM

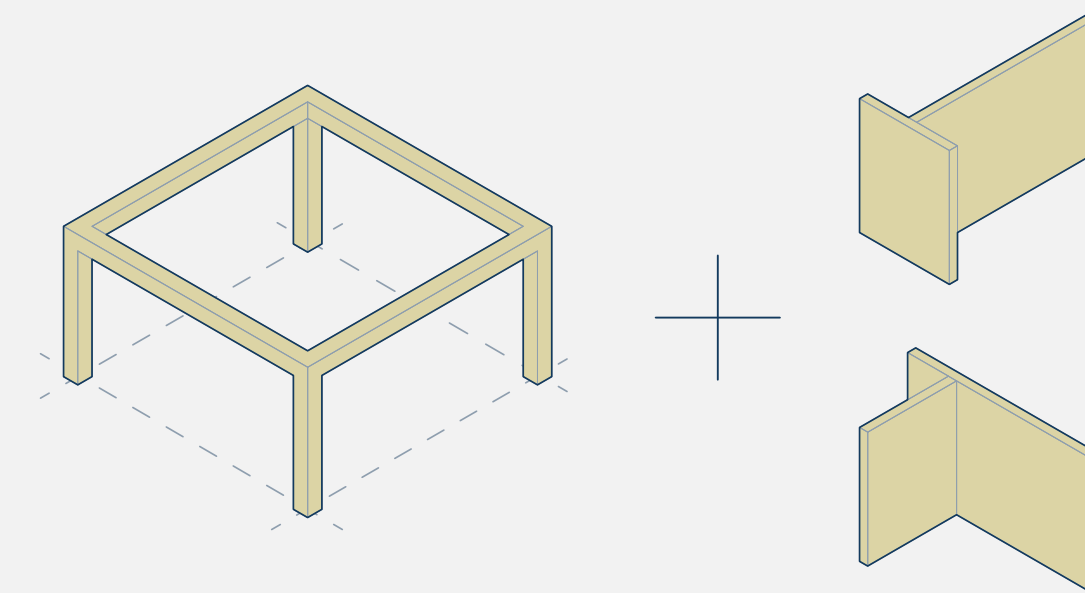
- 6 x 6 meters Glulam system
- Post & beam structure
- Optimizing construction and minimizing material usage



- Design for Disassembly (DfD)



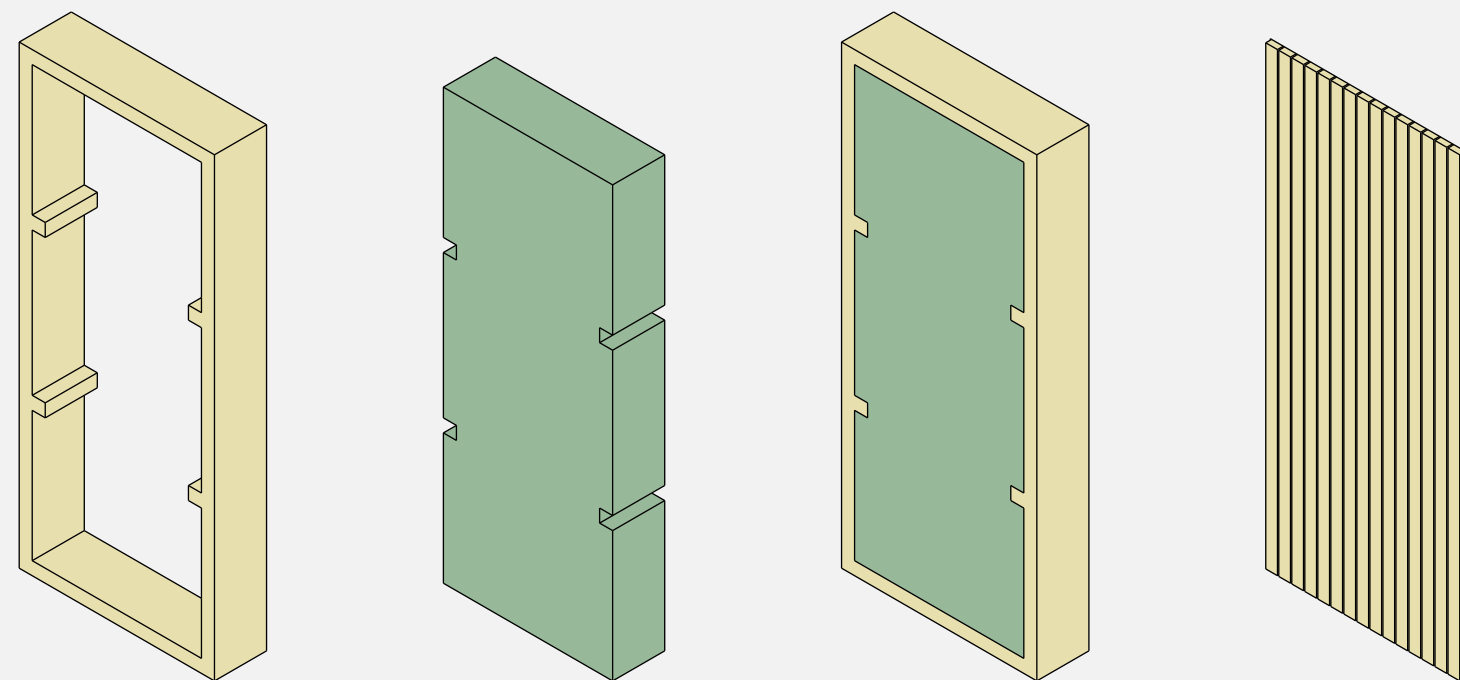
- Adaptable



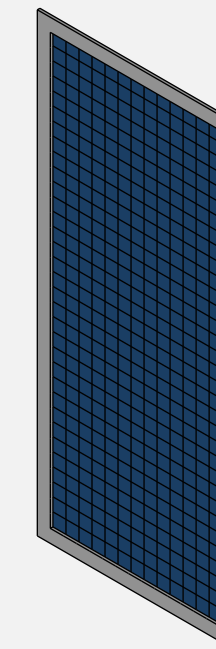
- Flexible infills

FAÇADE SYSTEM

- Façade is seen as energy potential

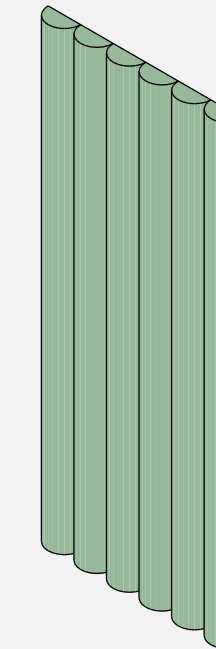


- Ecococon framing with straw insulation
- Biobased rice husk Cirqlar panels



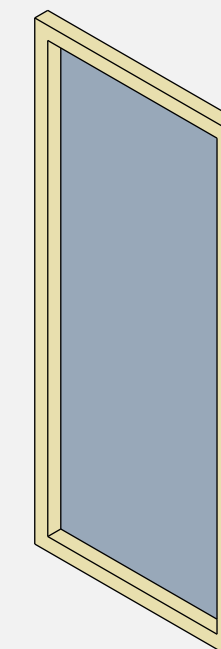
- Creates energy

- Building integrated PV



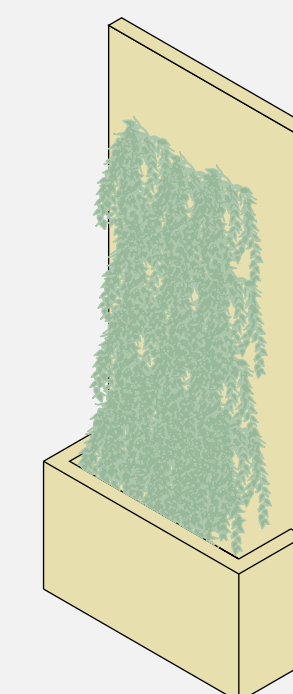
- Creates biomass
- Absorbs CO₂
- Creates heat

- Algae façade



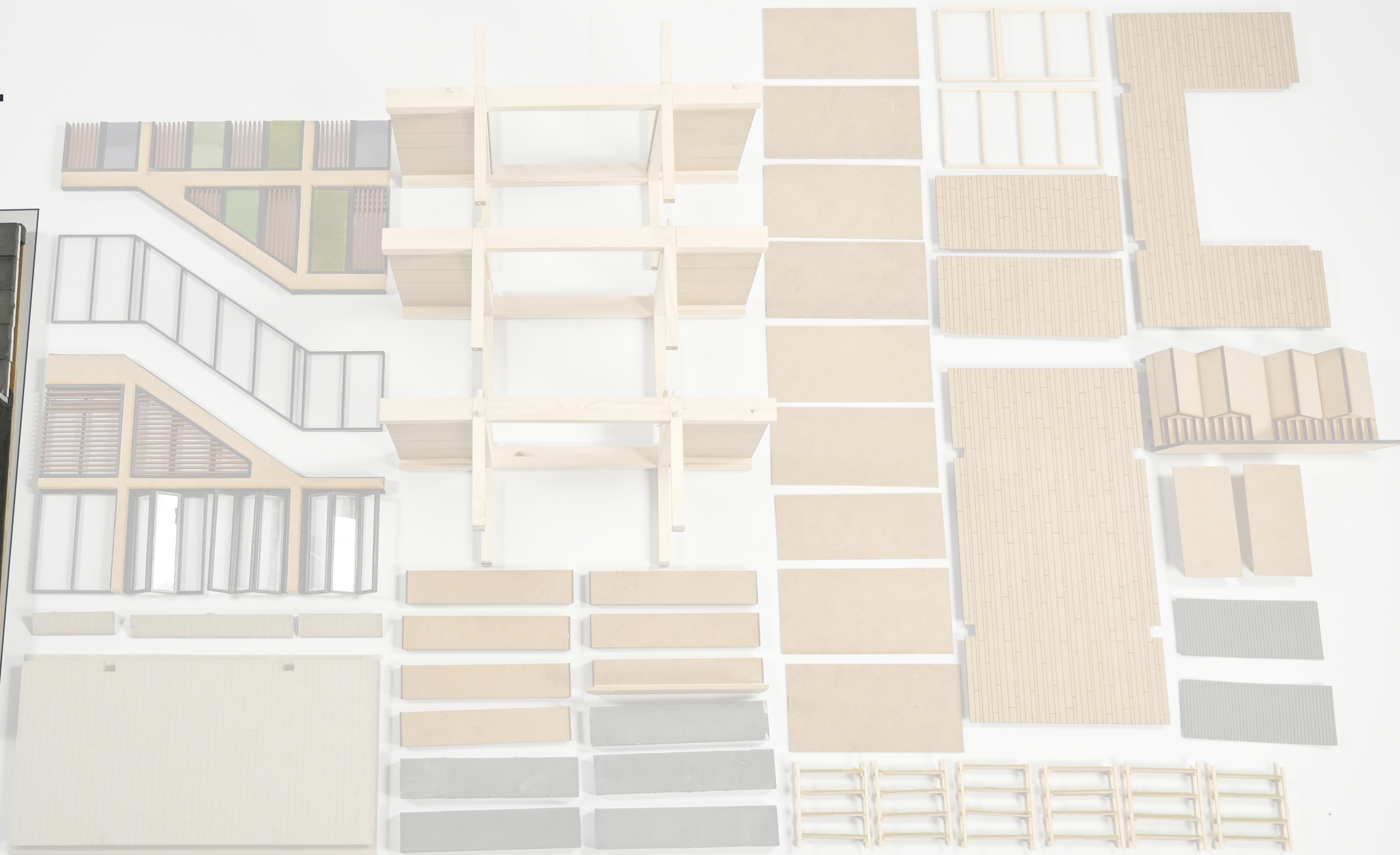
- Allow for solar gains

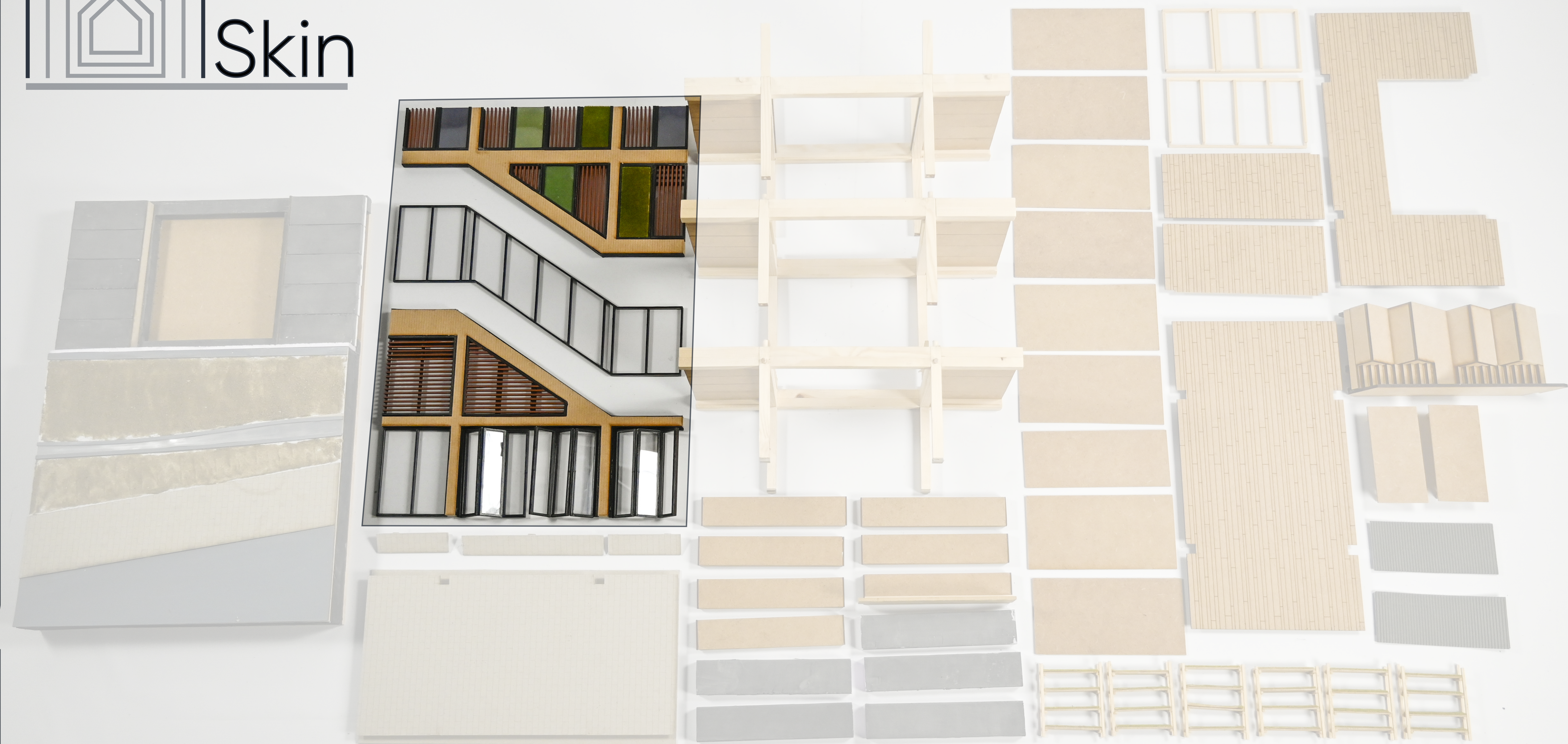
- Windows

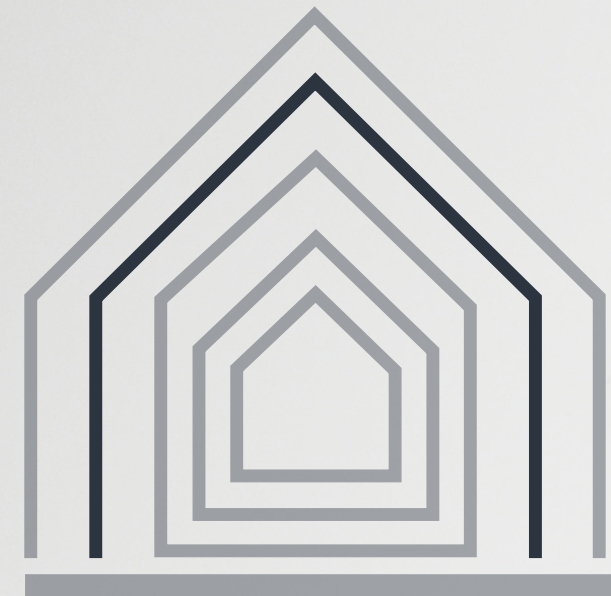


- Creates biomass
- Hosts biodiversity

- Green façades



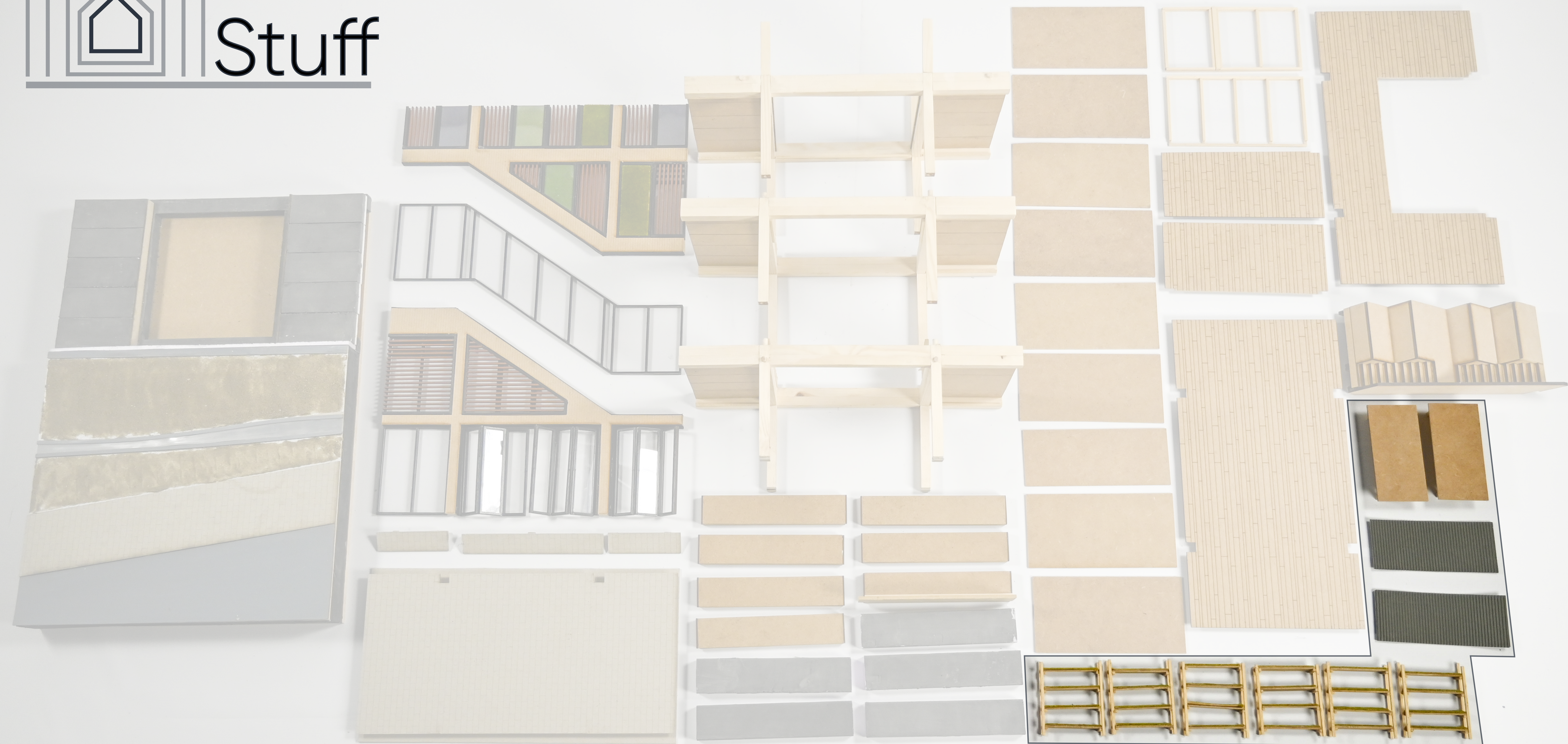




Structure

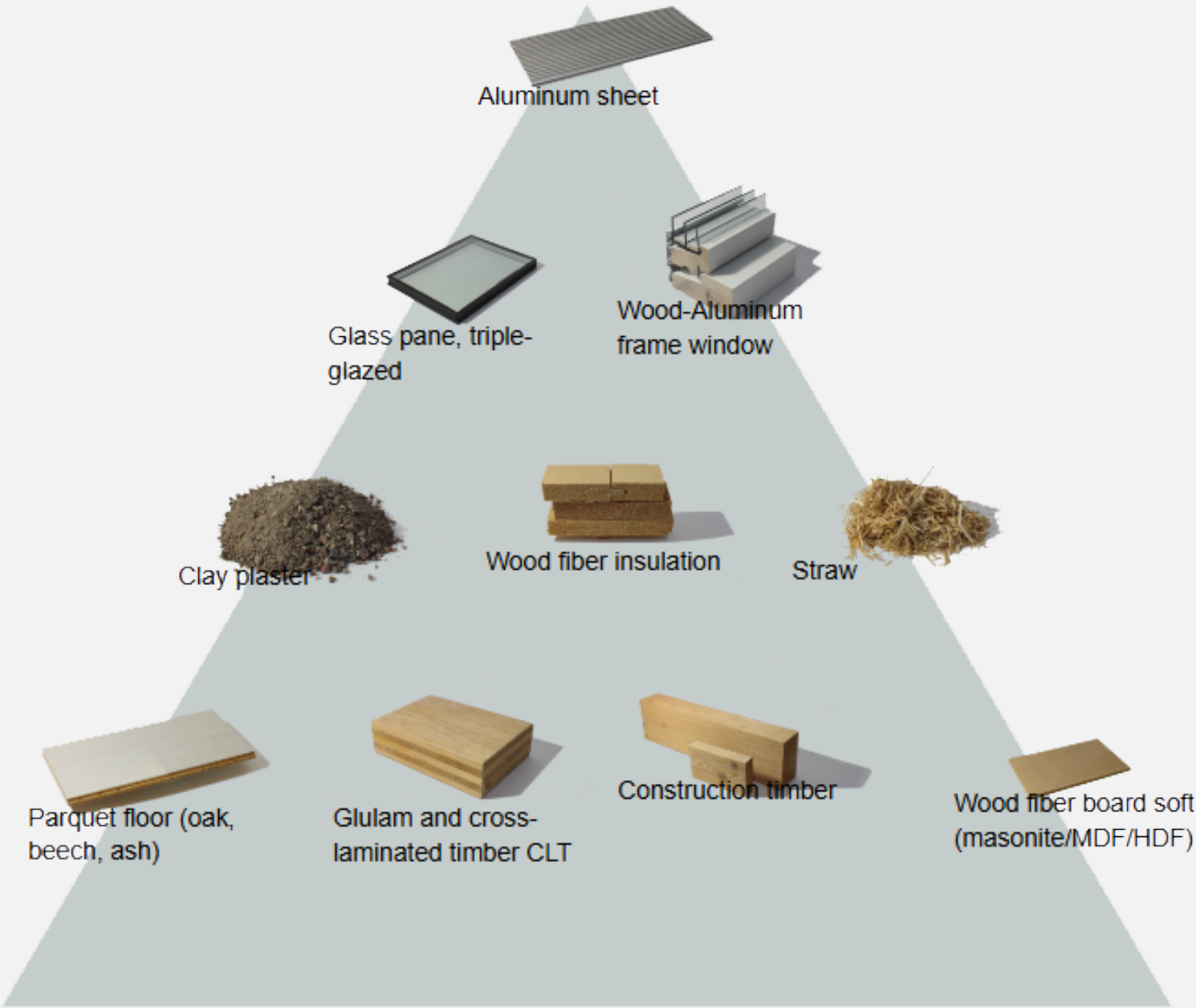




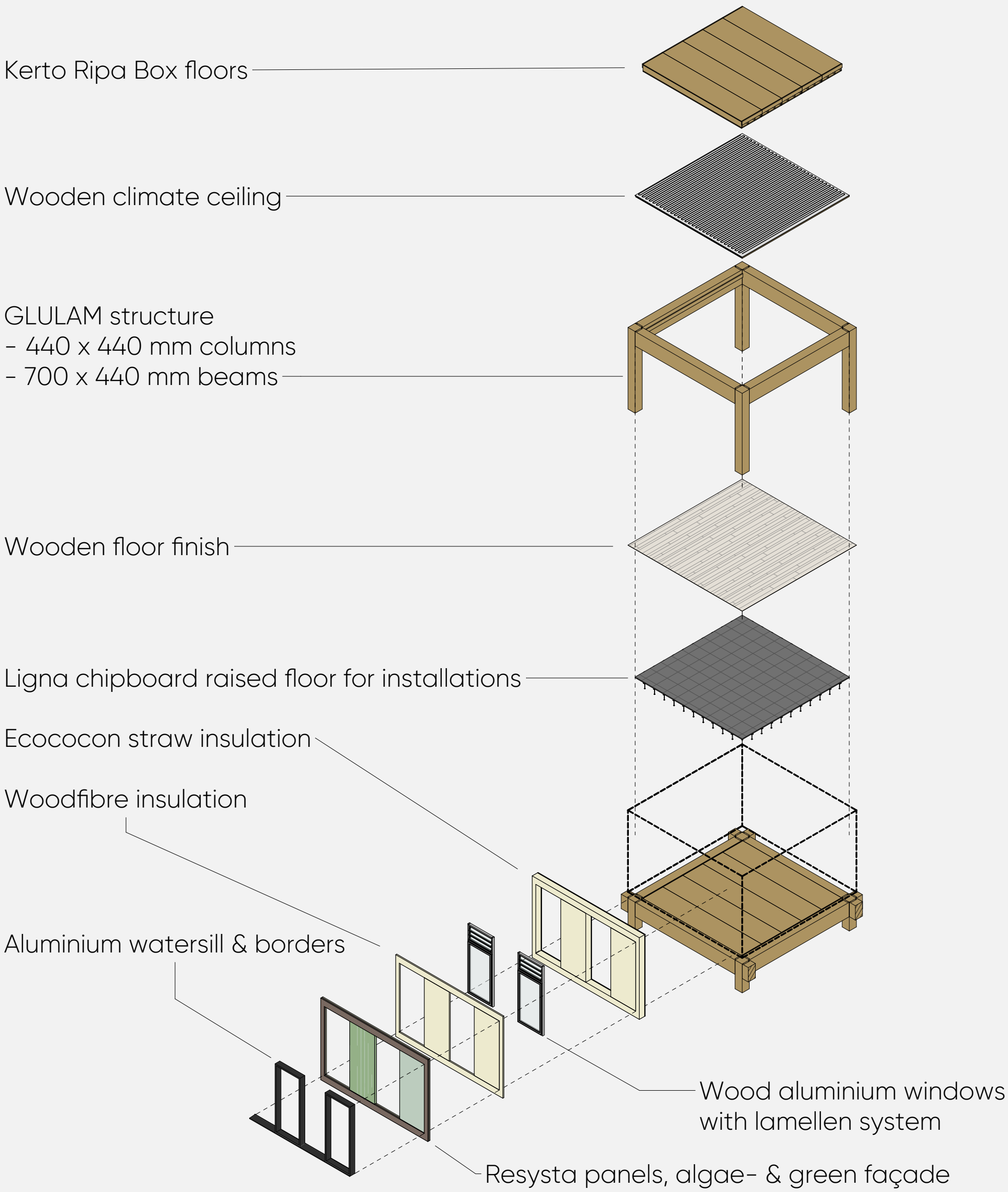


BIOBASED VARIANT

- Assessment of different environmental impacts
- Comparison

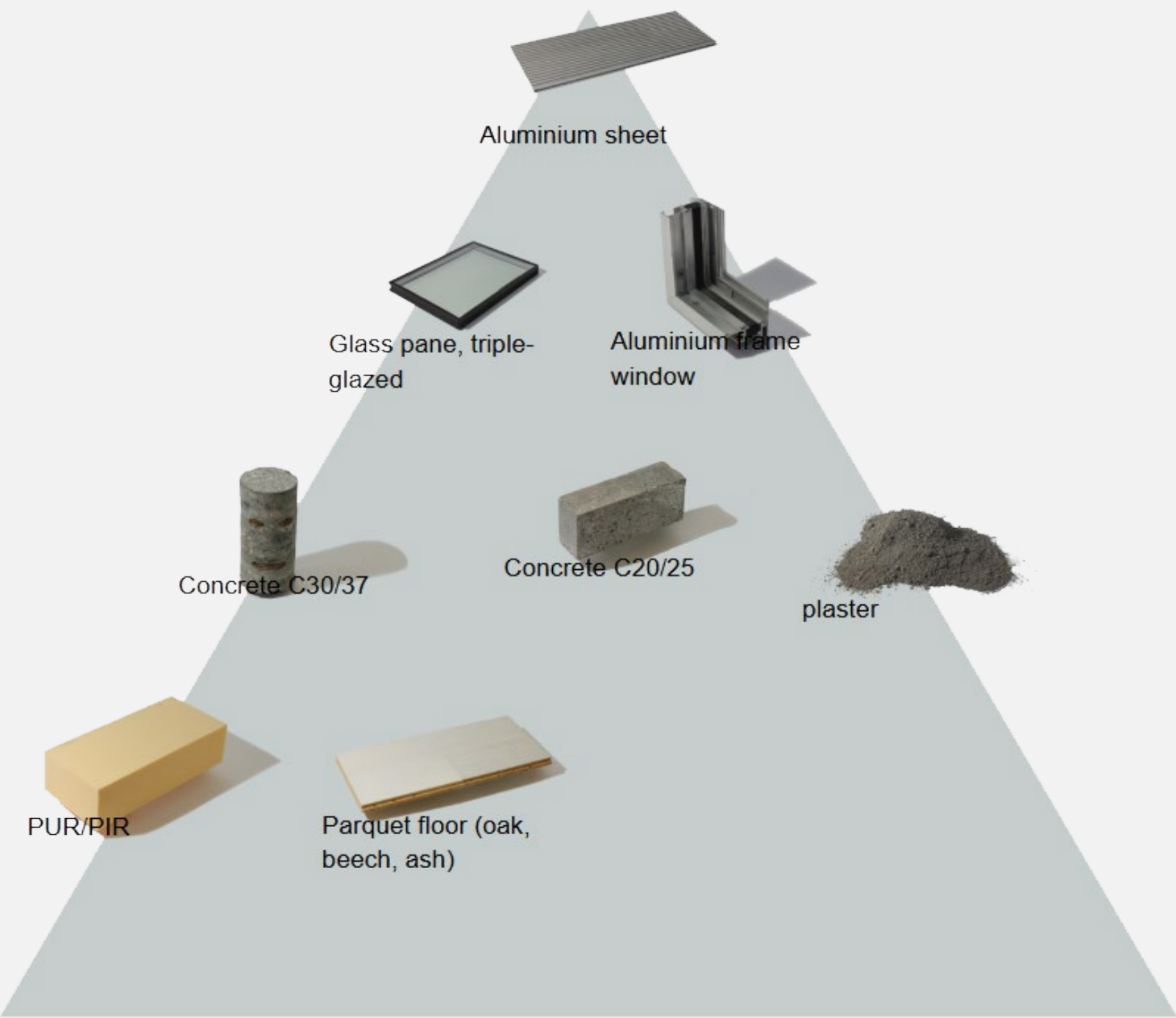


Biobased variant (Climate Condensers)

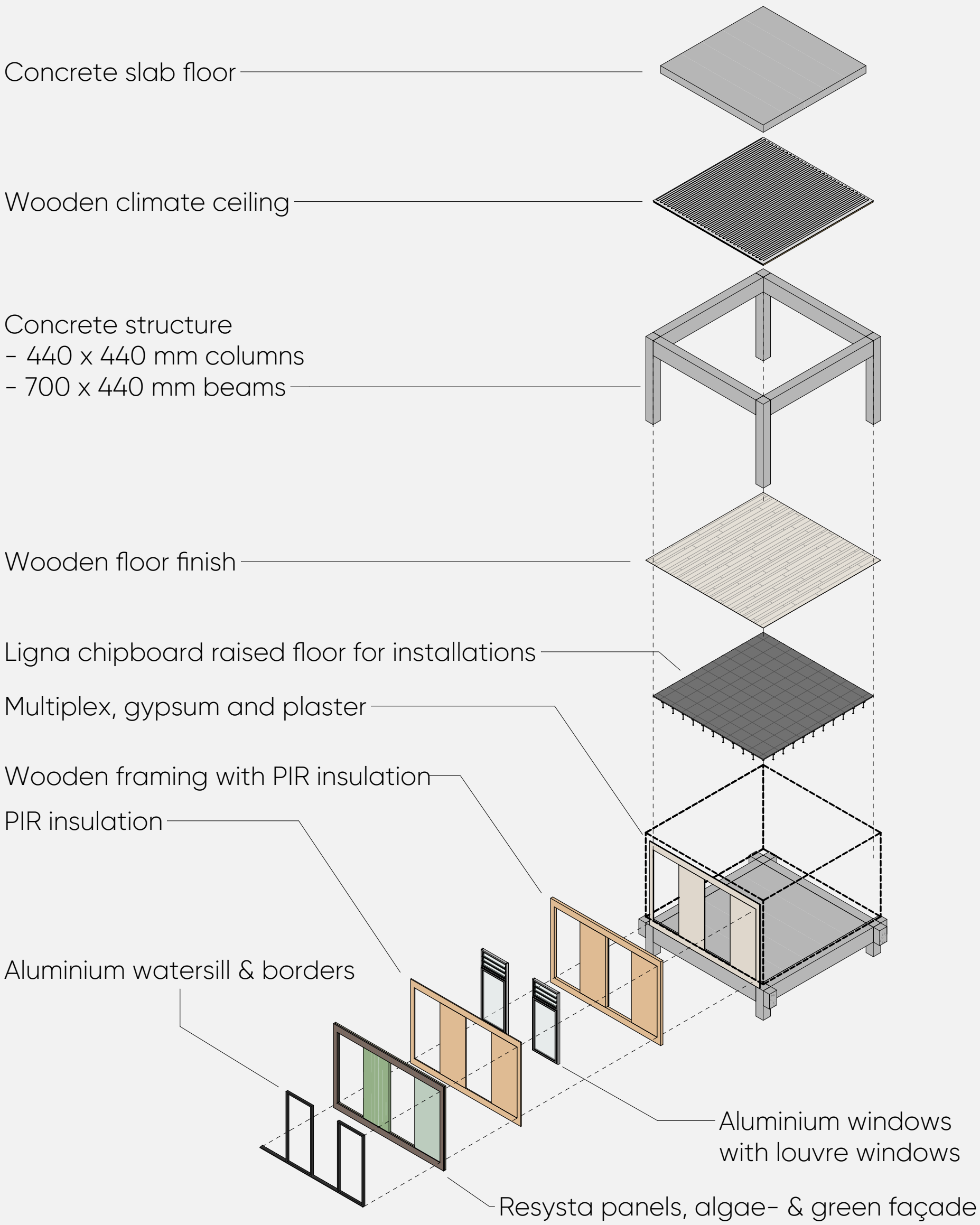


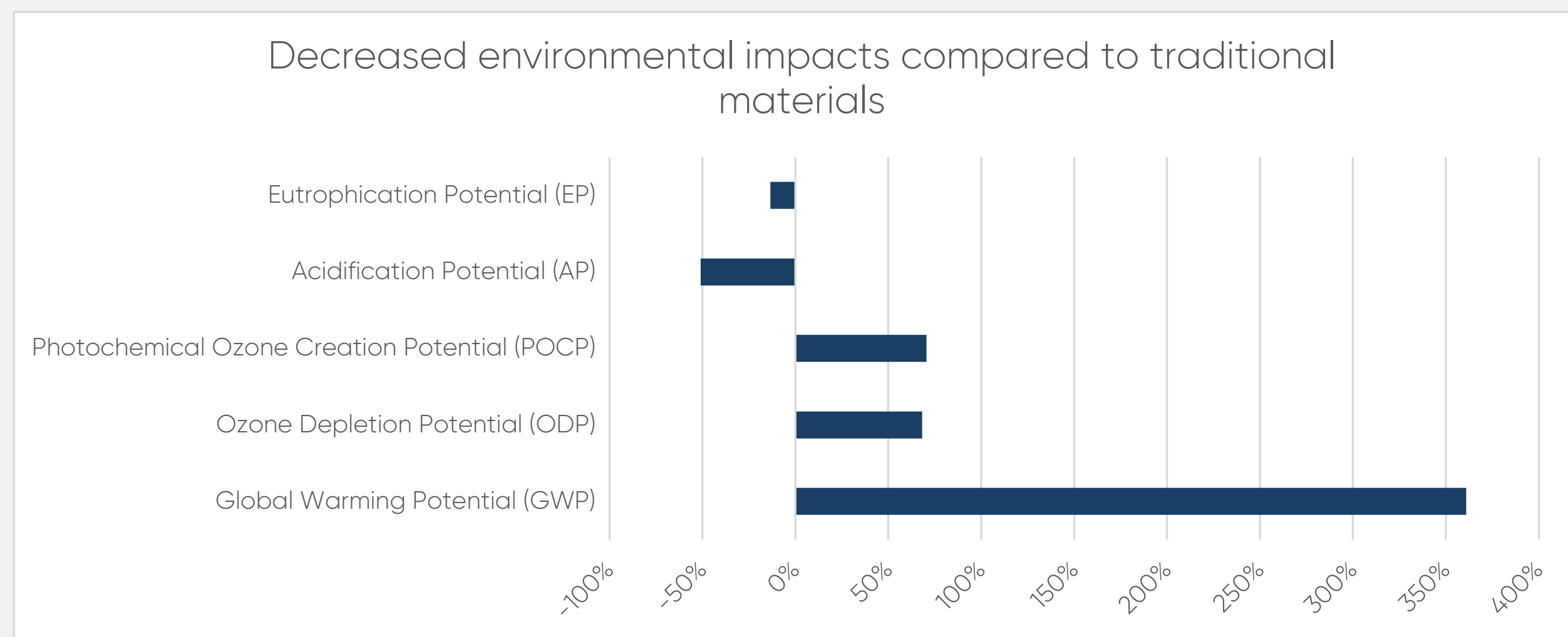
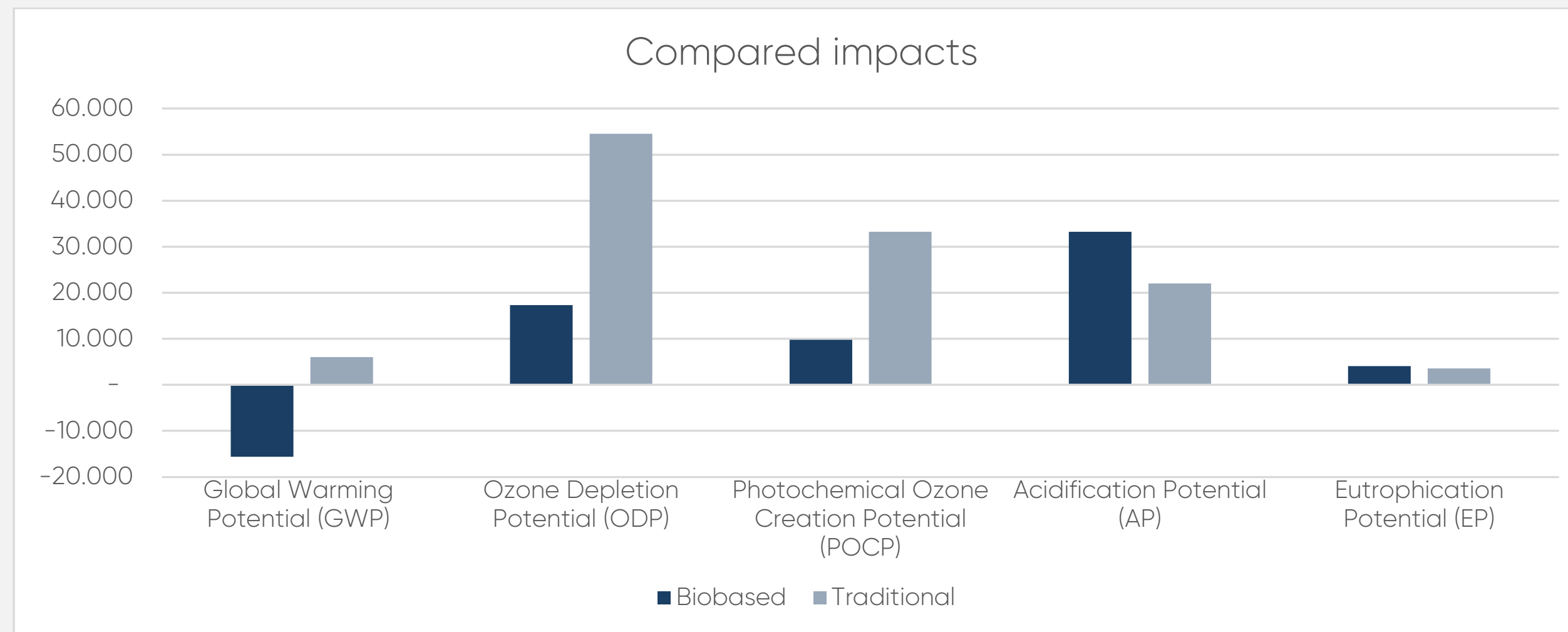
CONCRETE VARIANT

- Assessment of different environmental impacts
- Comparison



Concrete variant (Traditional approach)



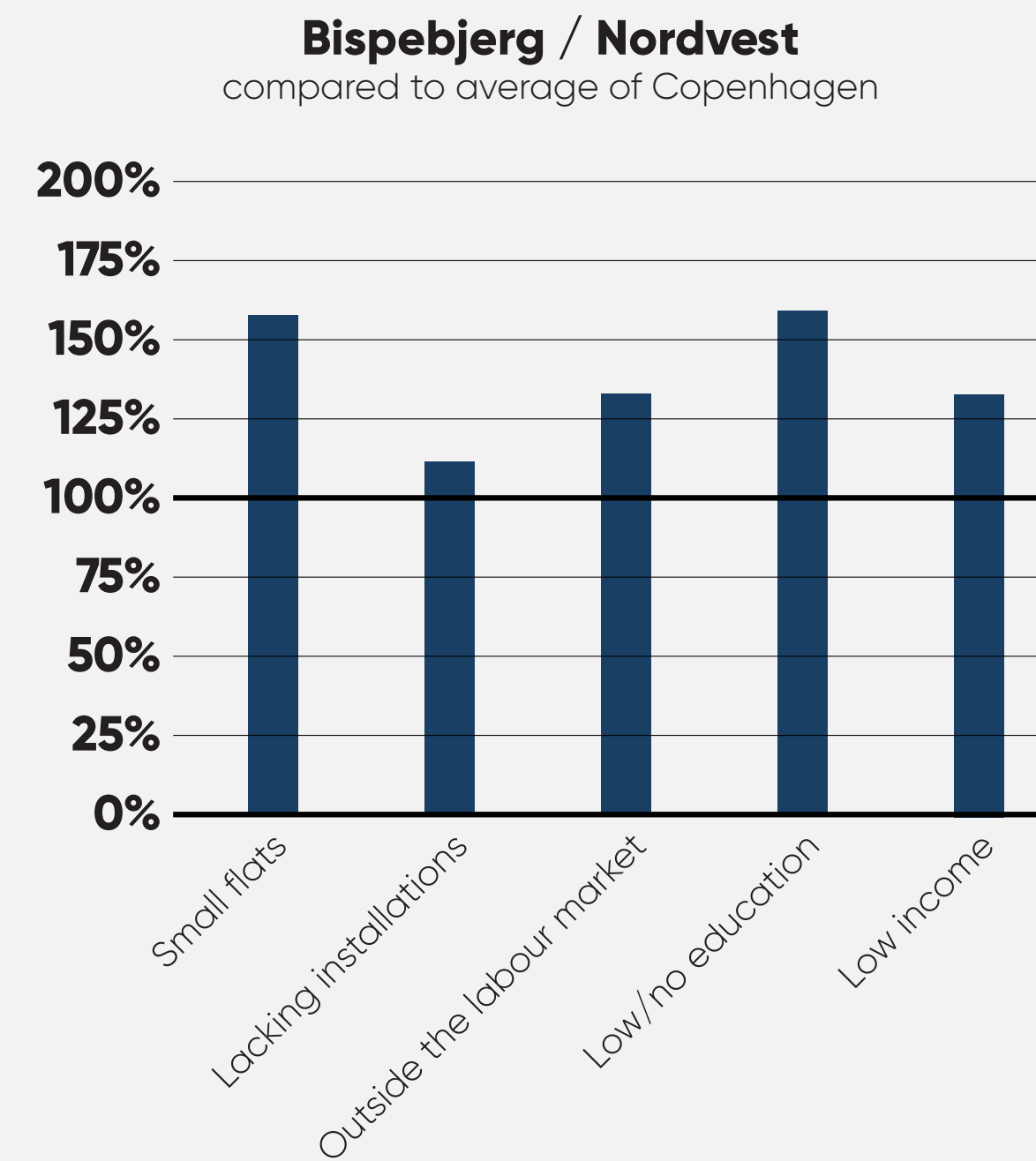


SITE.

SITE AREA & RELATION TO RESEARCH



District in Copenhagen



- Bispebjerg, Copenhagen
 - Lower socio-economic status correlates with lesser:
 - Climate change knowledge
 - Climate concerns
 - Local climate action
- (S. Nielsen, 2023)

CHARACTERISTICS

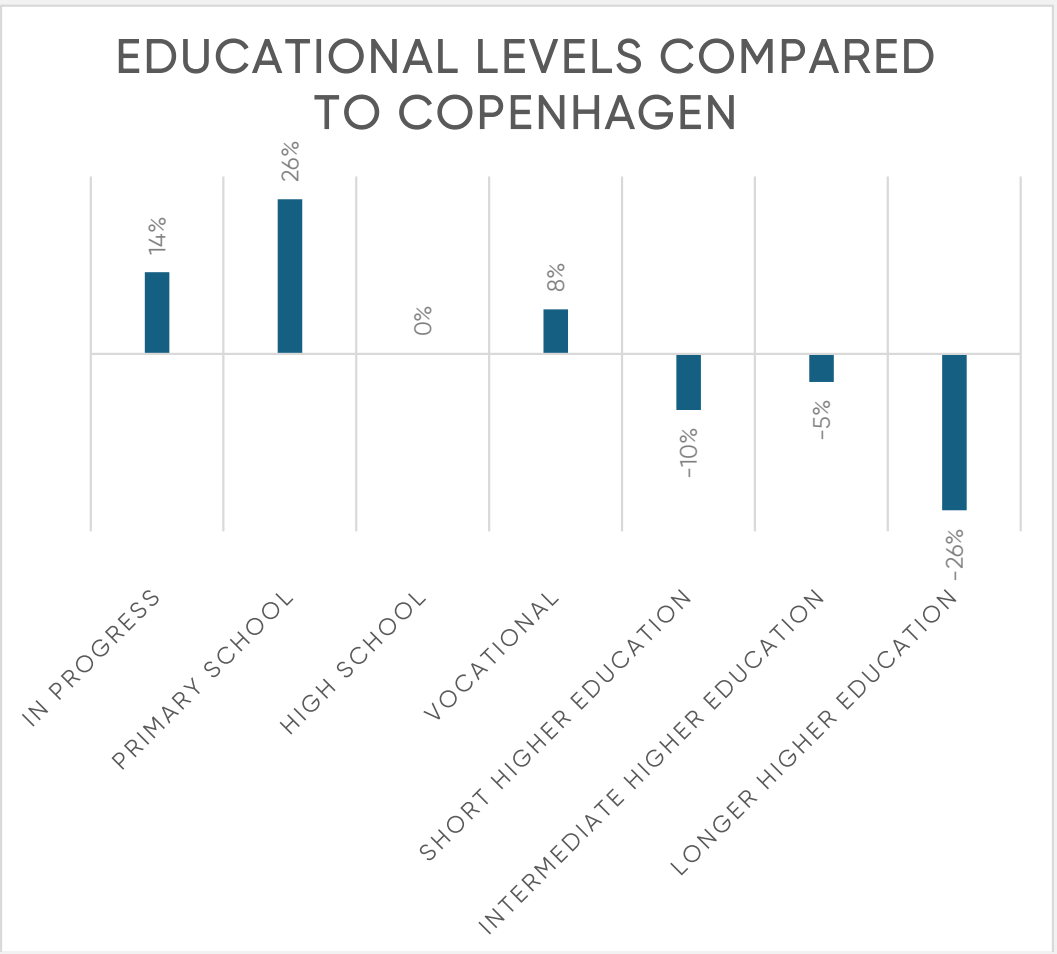
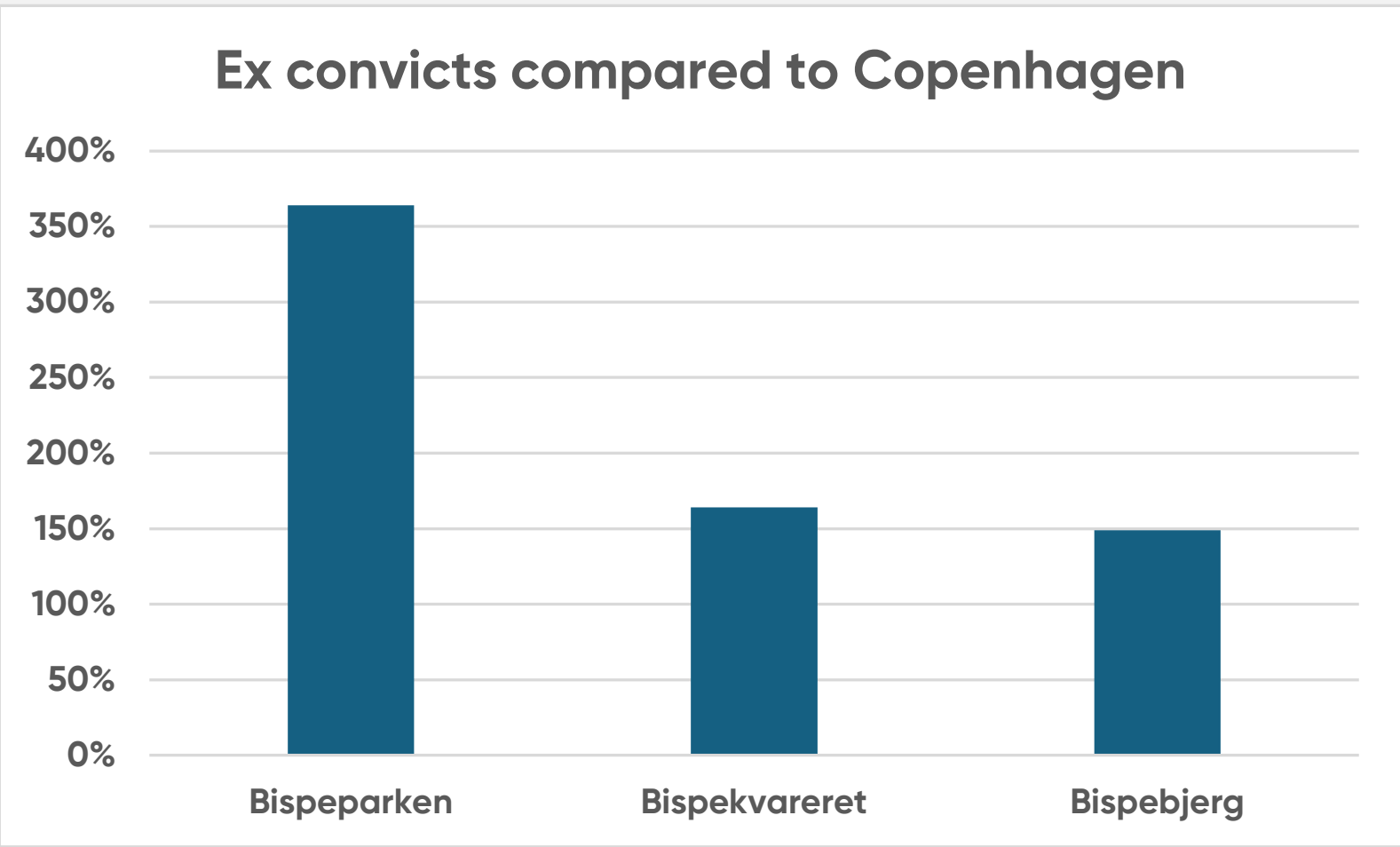
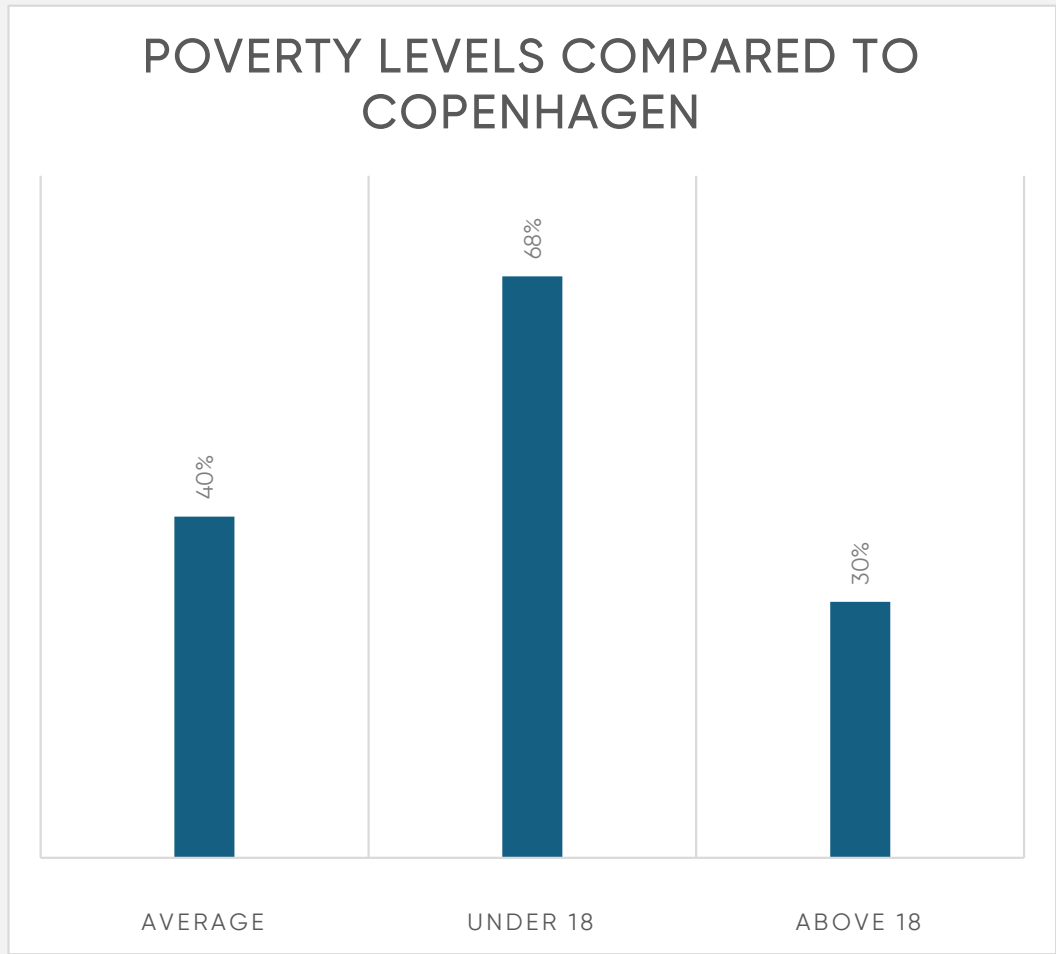
- Diverse cultural backgrounds
- Degradation
- Homelessness
- Criminality
- Gentrification



Characteristics of the area

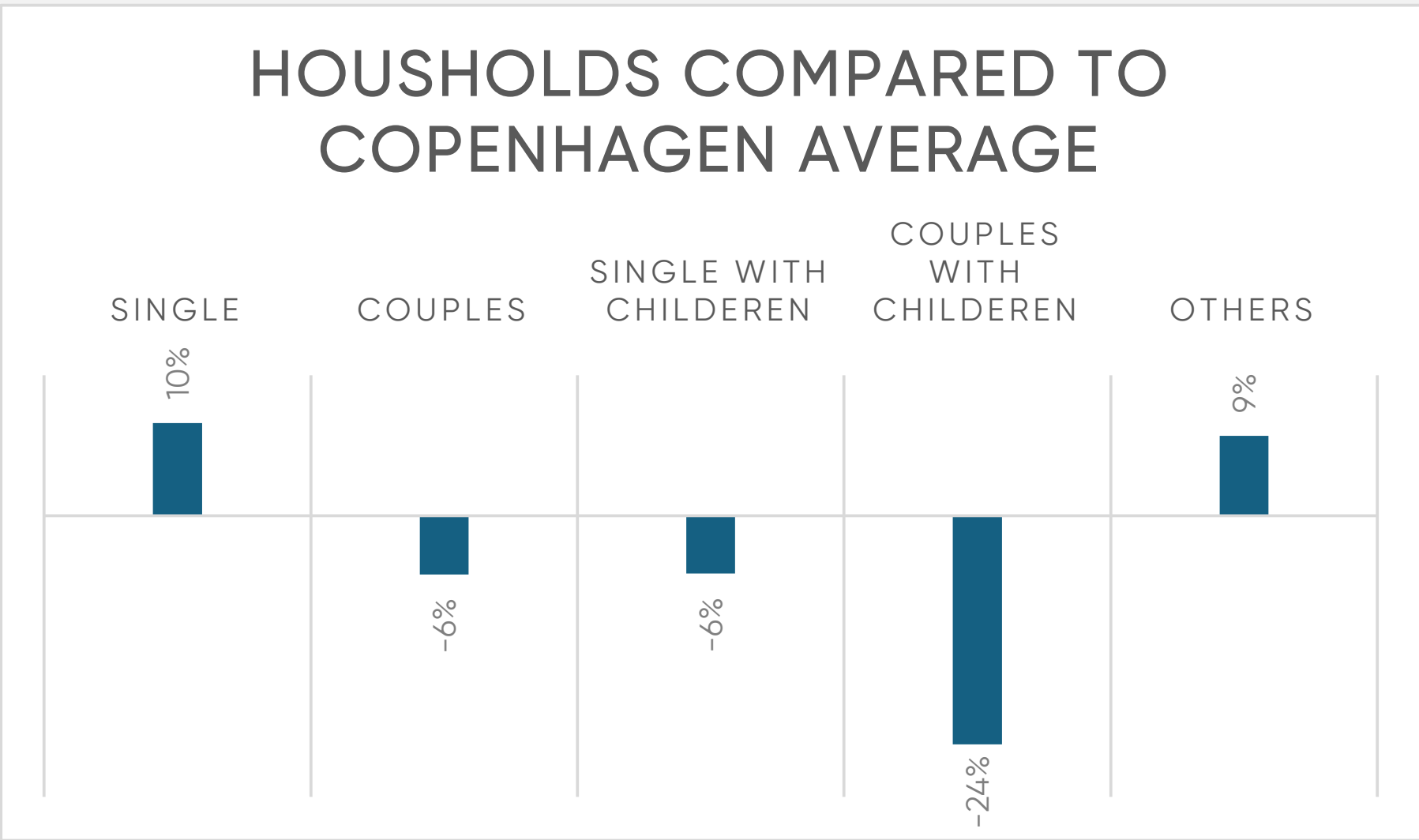
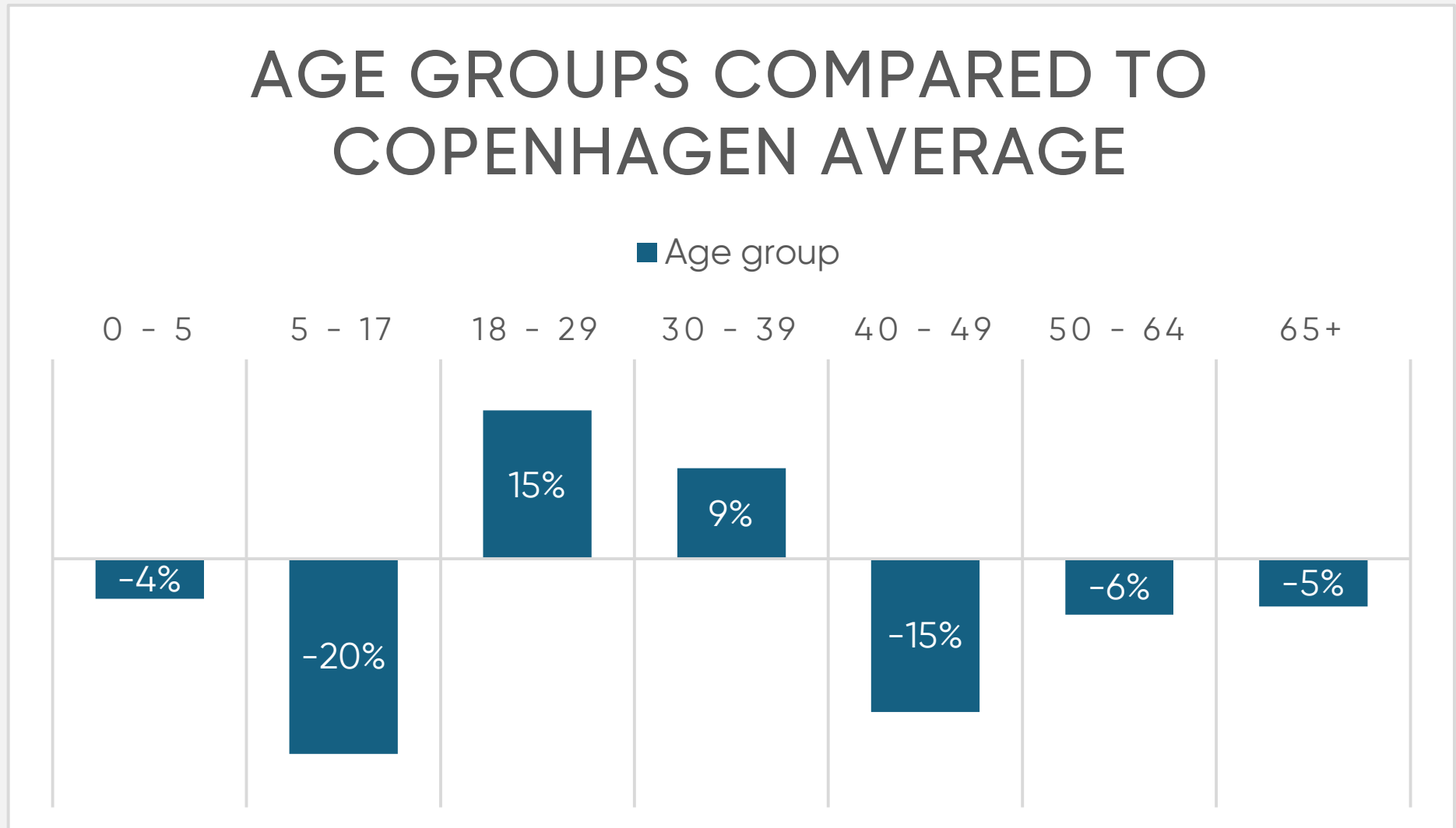
STATISTICS BISPEBJERG

- Higher poverty levels
- More ex convicts
- Lower education levels



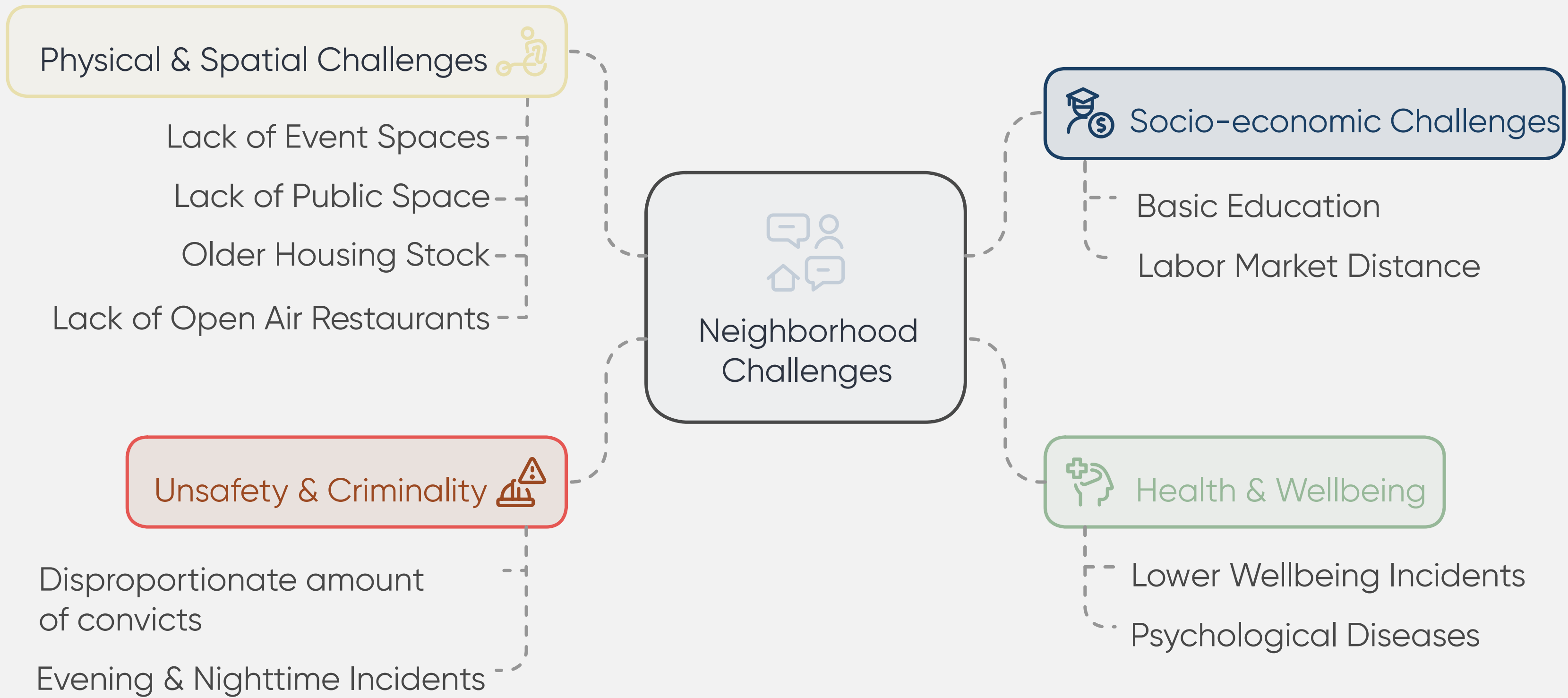
STATISTICS BISPEBJERG

- More singles and other households
- Relatively young adults



NEIGHBORHOOD CHALLENGES

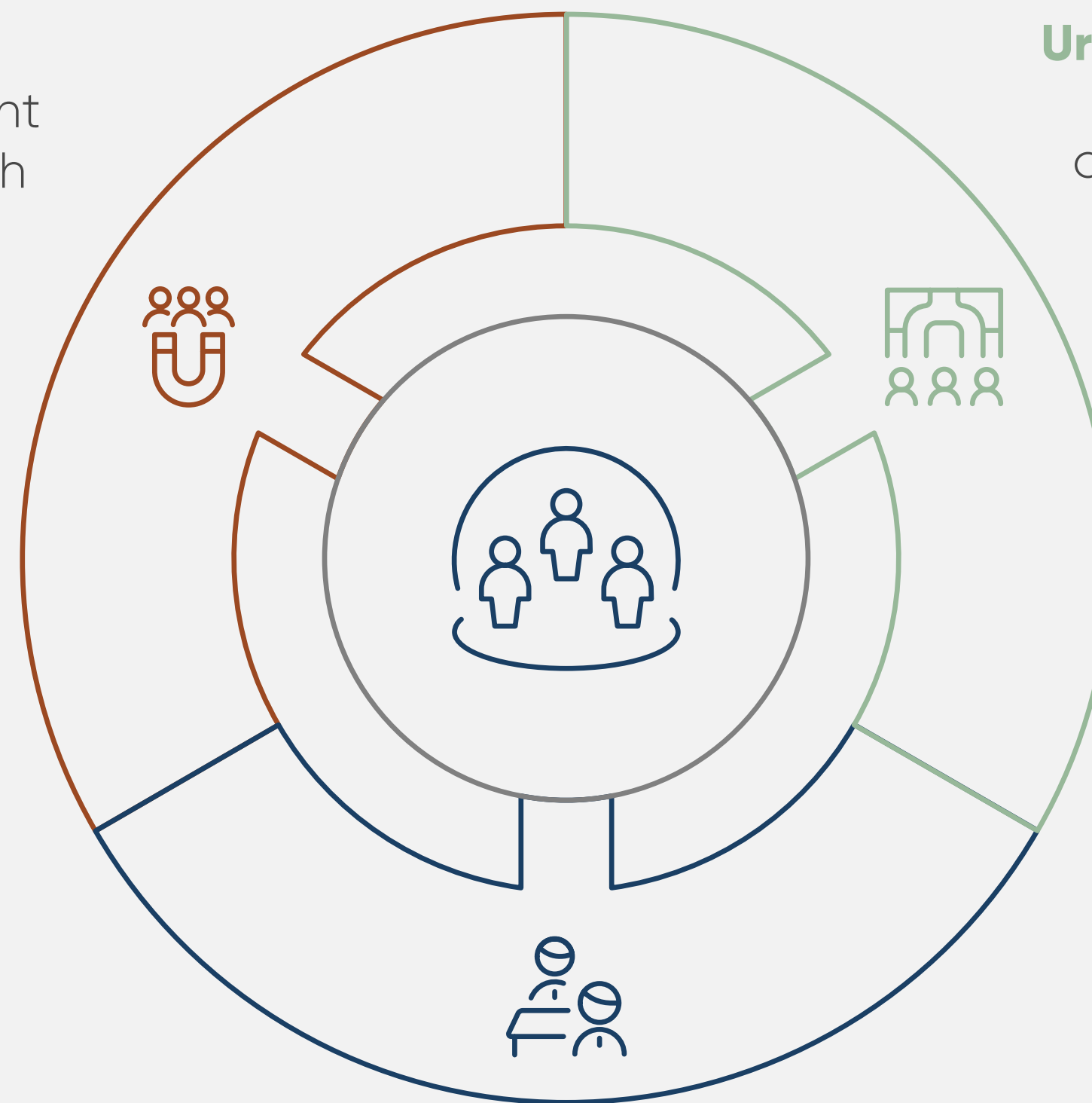
- Analysis "BISPEKVARTERE Kommende områdefornyelse" by municipality



ARCHITECTURAL GOALS

**Labor Market
Access**
Improving employment
opportunities through
education and job
availability

Urban space deficiencies
Create spaces for
cultural & educational
activities



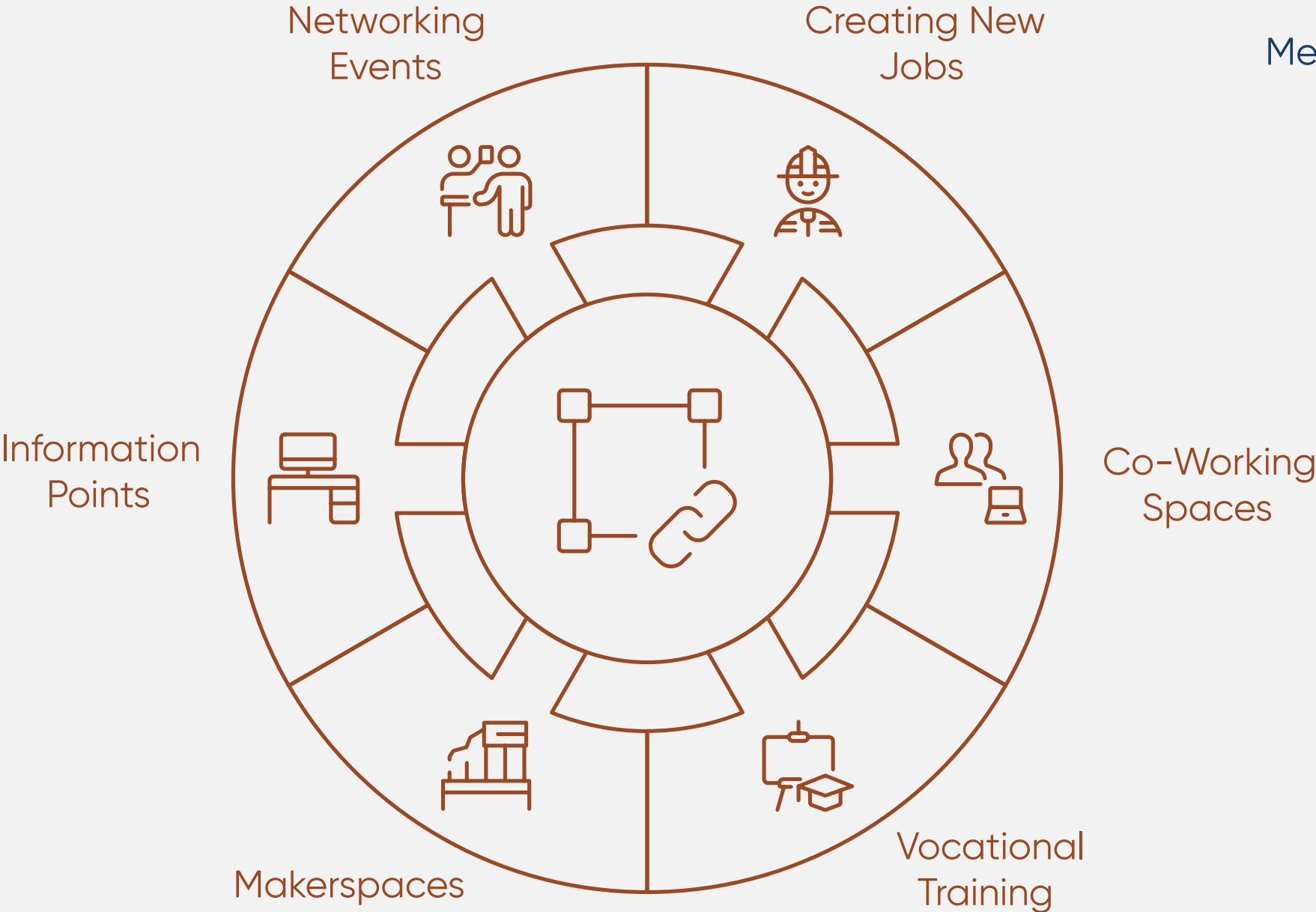
**Positive Learning
Environment**
Education facilities
to create equal opportunity
for children & safe spaces

ARCHITECTURAL IMPLEMENTATIONS

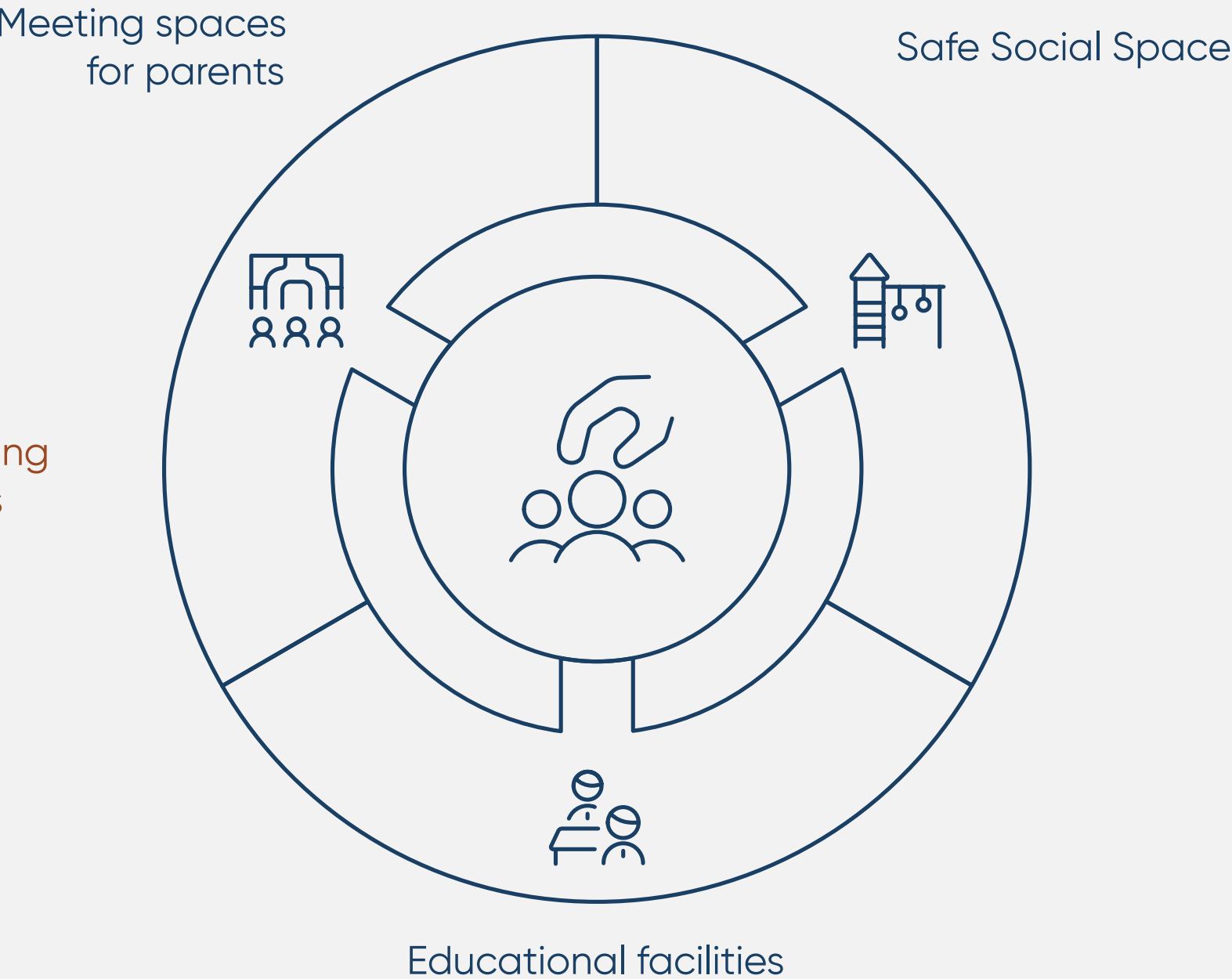
Addressing Urban Space Deficiencies



Lowering Labor Market Barriers



Positive learning environment



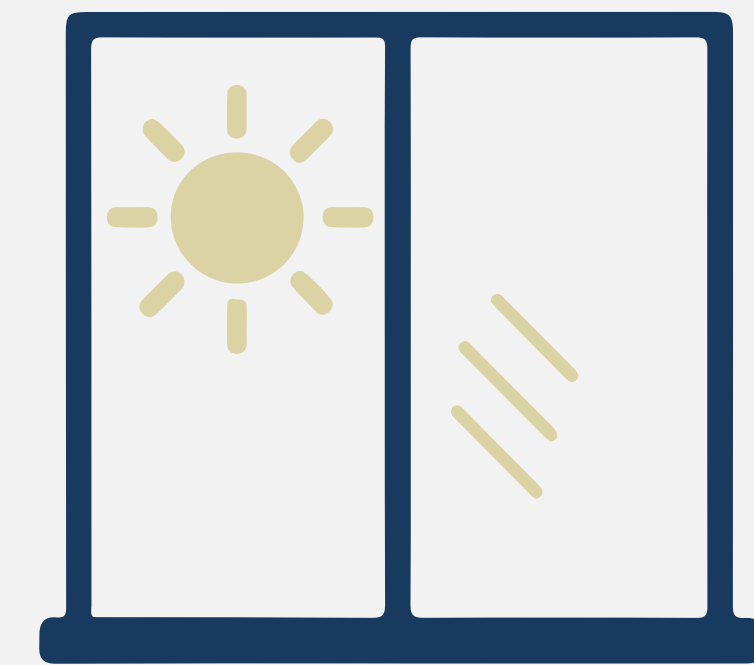
BIOPHILIC DESIGN



Building integrated
vegetation



Landscaping



Daylight



Nature interaction



Natural materials,
textures & colors

PLOT AREA

Plot location within Bispebjerg



Bispebjerg Copenhagen



Site area with chosen plot

PLOT LOCATION



View from north side



Main entrance of shopping mall



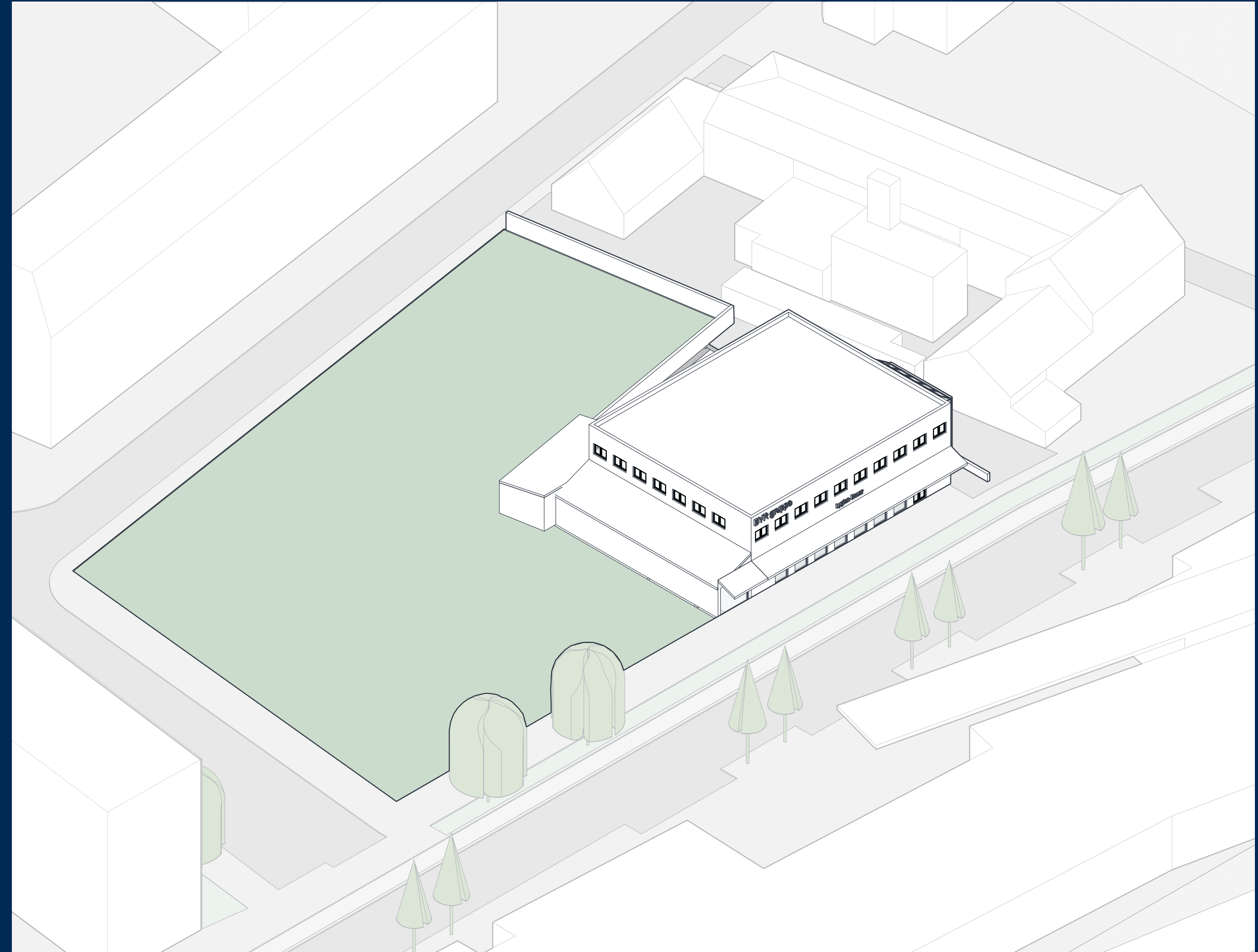
Grocer next to plot

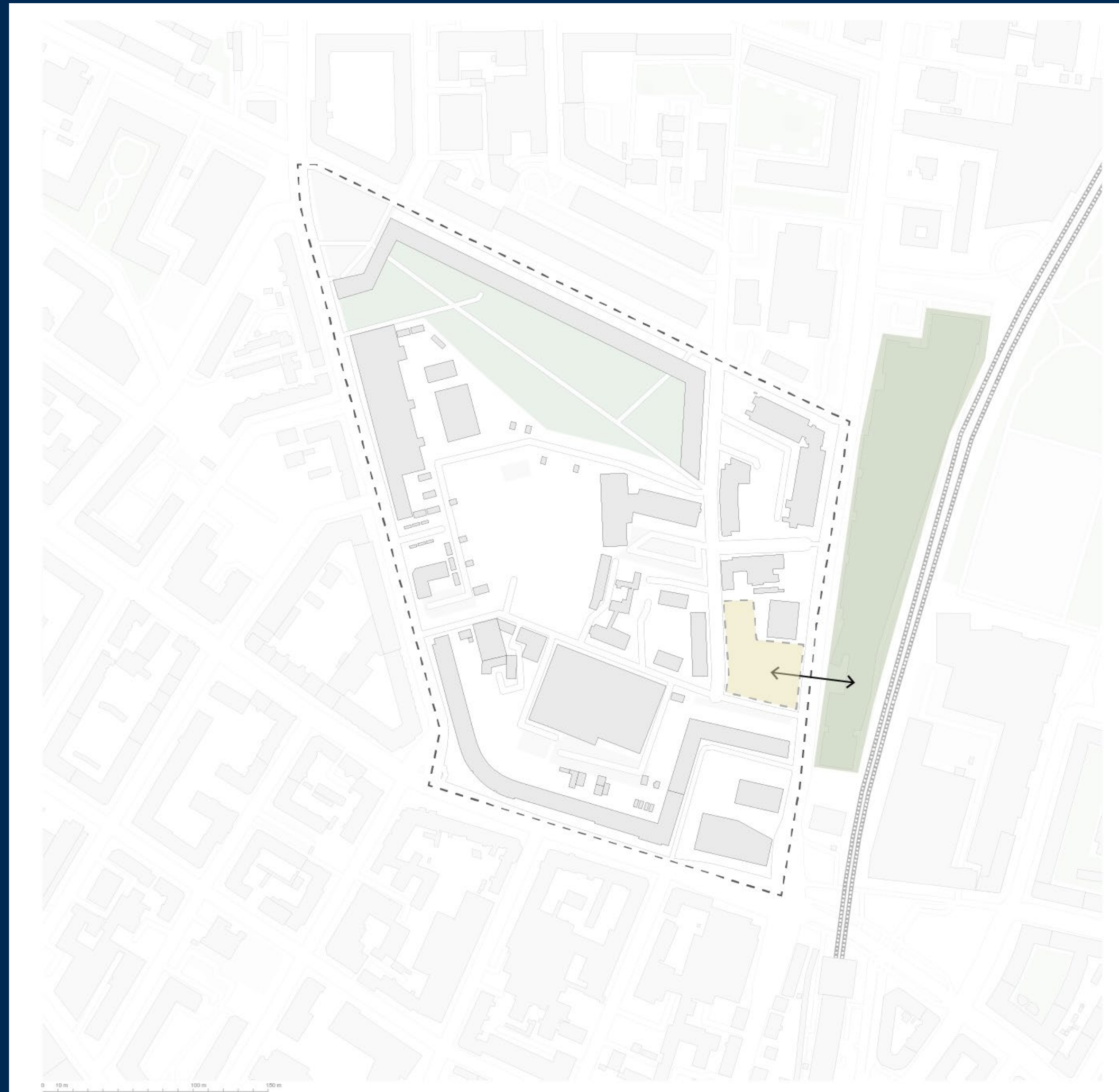


View from south side

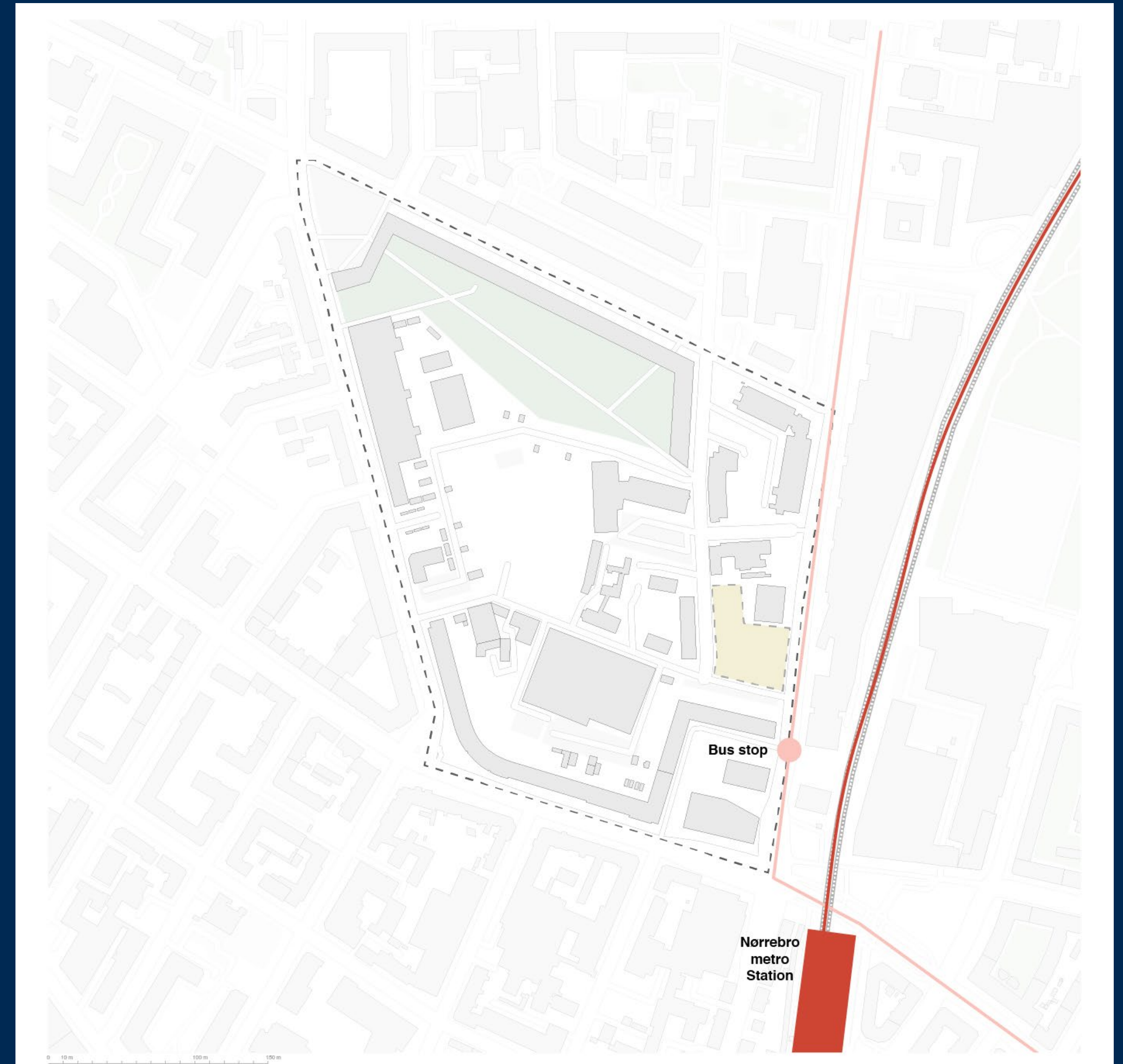
DESIGN ON SITE.

ANALYSIS SUMMARY





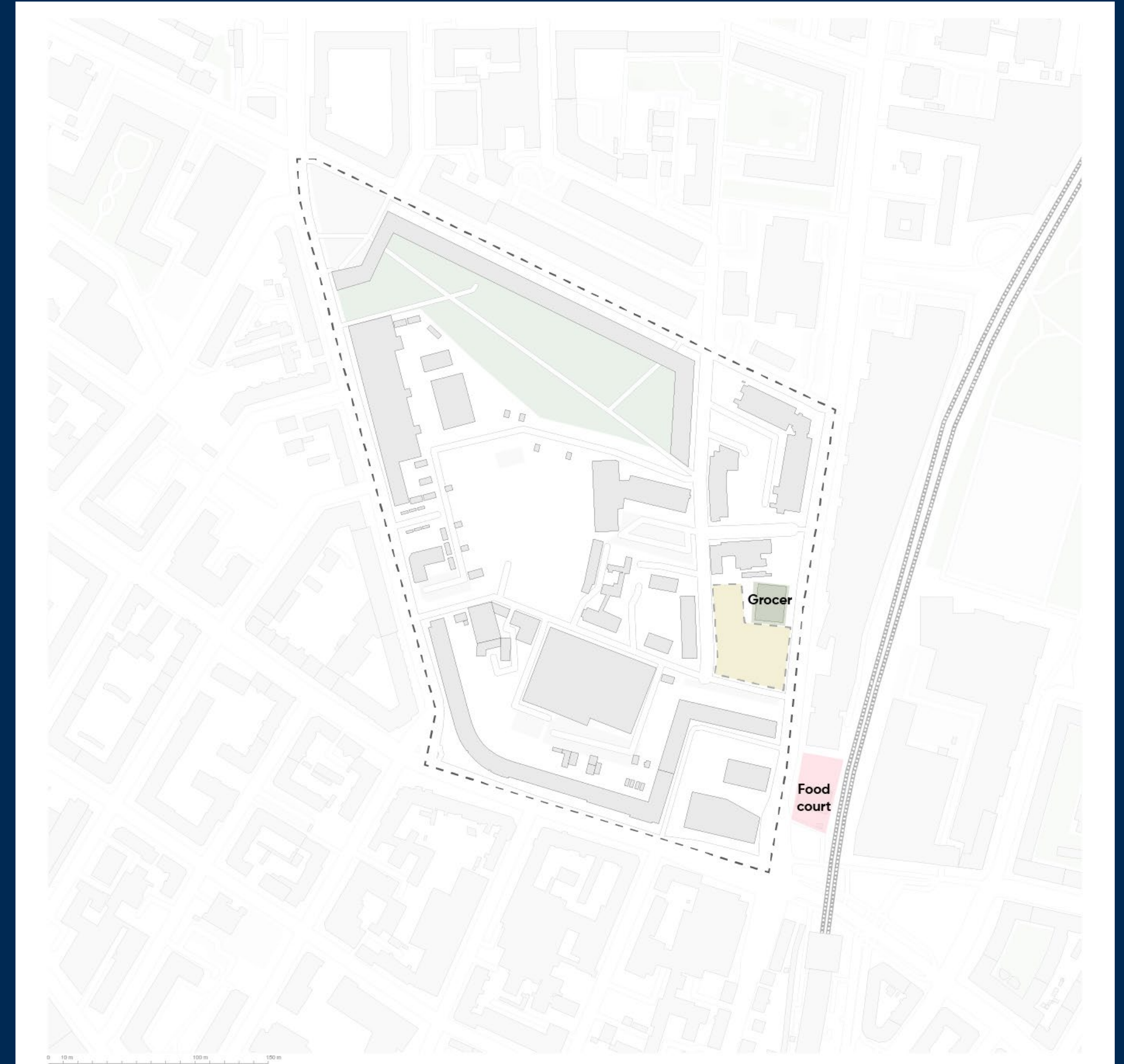
MAIN ENTRANCE SHOPPING MALL ATTRACTS
VARIOUS USERS FOR CLIMATE CONDENSER



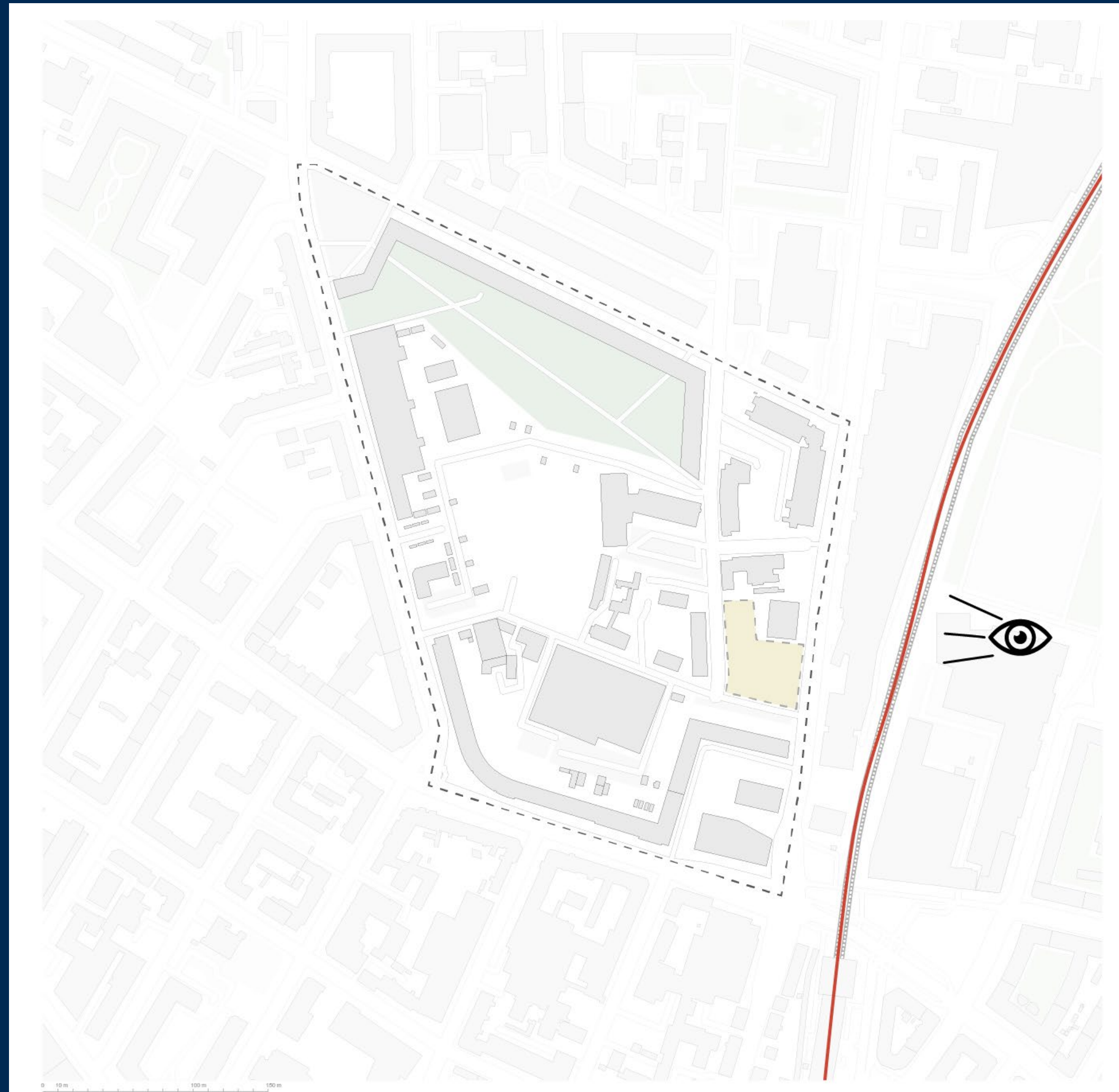
CLOSE PROXIMITY OF PUBLIC TRANSPORT



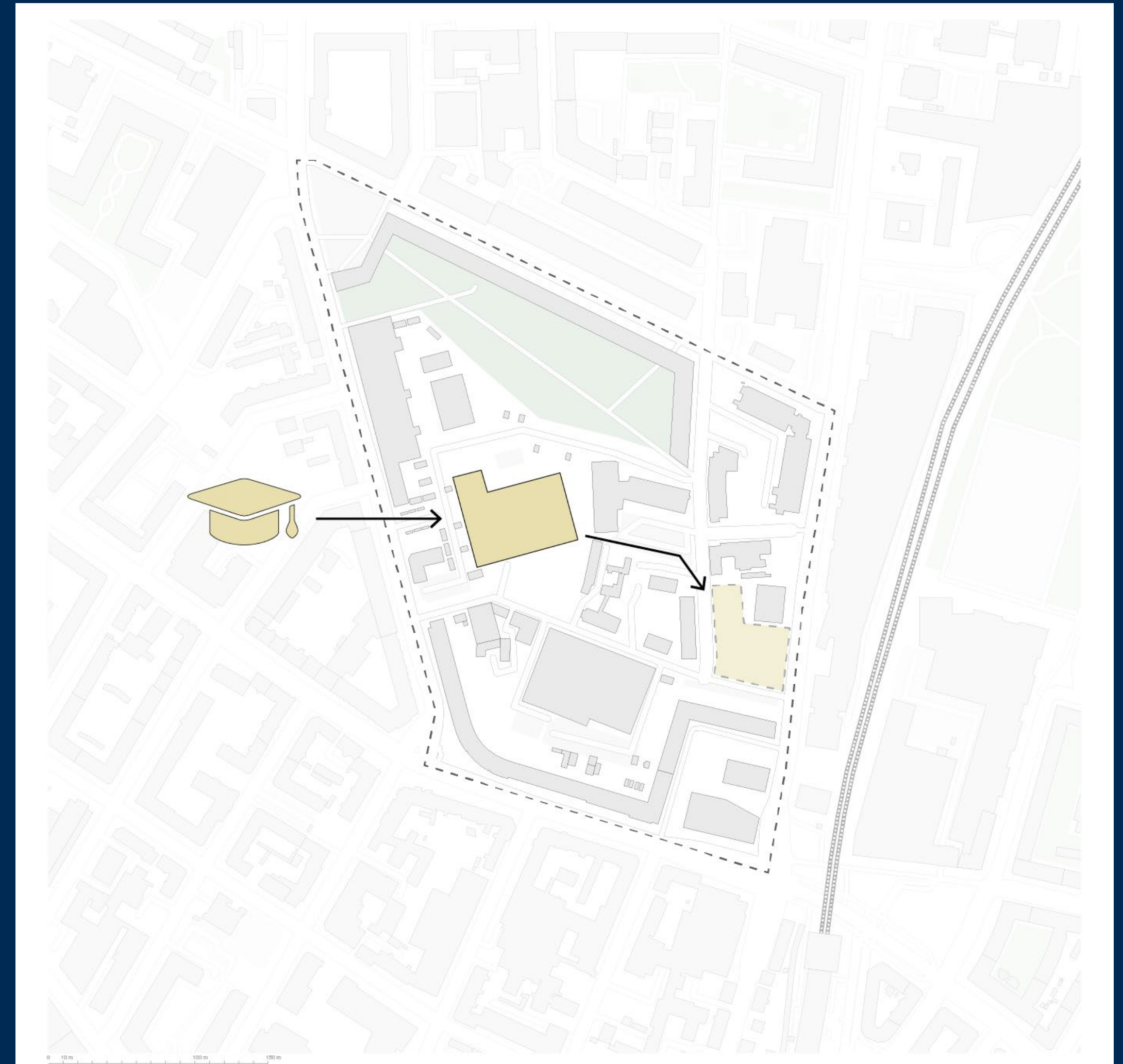
EXTENSION AND REINFORCEMENT OF LOCAL GREEN NETWORKS



EXCHANGE OF PRODUCE FROM URBAN AGRICULTURE WITH GROCER / FOODCOURT



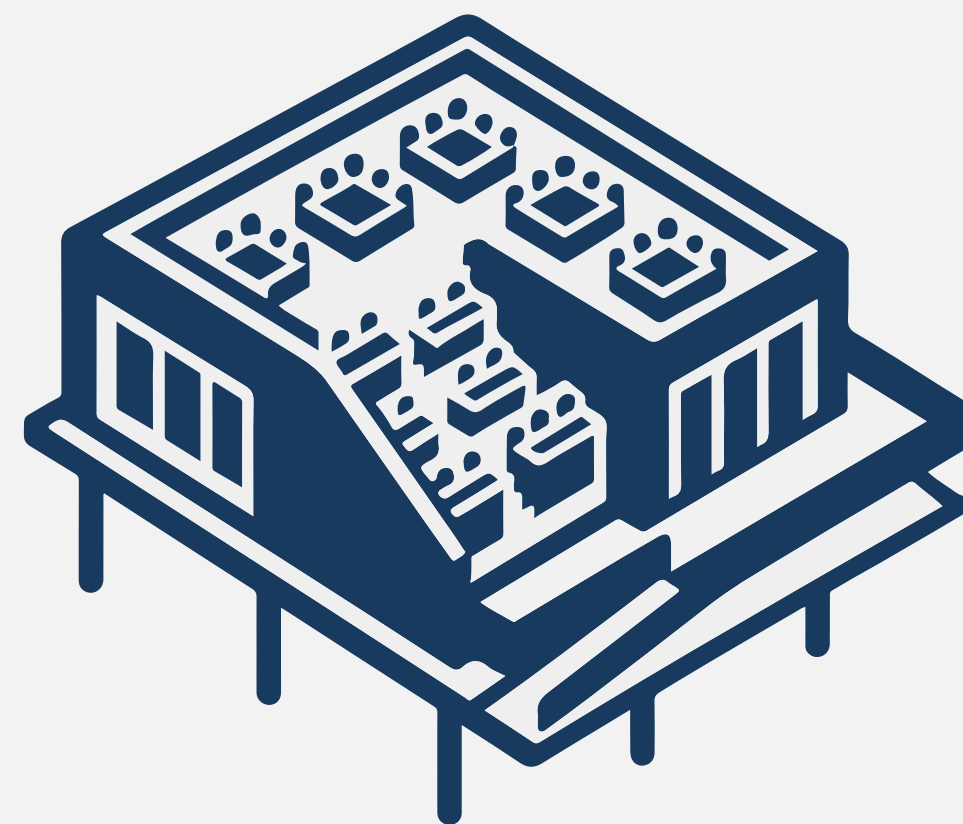
VISIBILITY FROM TRAIN SHOWCASES
PROTOTYPE TO MANY PEOPLE



EXTENSION FOR NEXT SCHOOL TO PROVIDE
SUSTAINABILITY LESSONS / AGRICULTURE

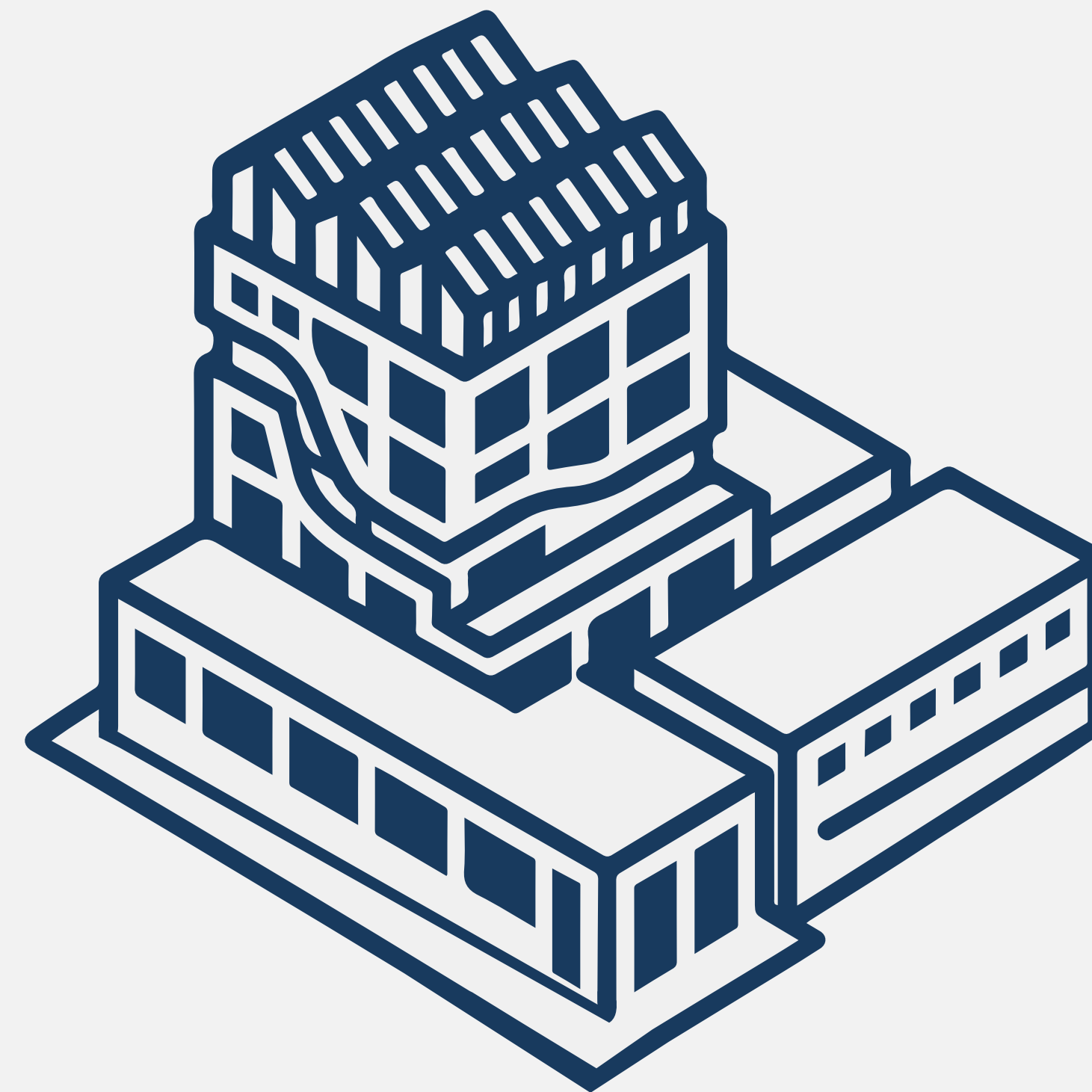
PROTOTYPE

- 6 x 6 Grid provides design structure
- Basic functions are defined
- Identity of prototype
- Recognizable agriculture routing



SPECIFIC BUILDING

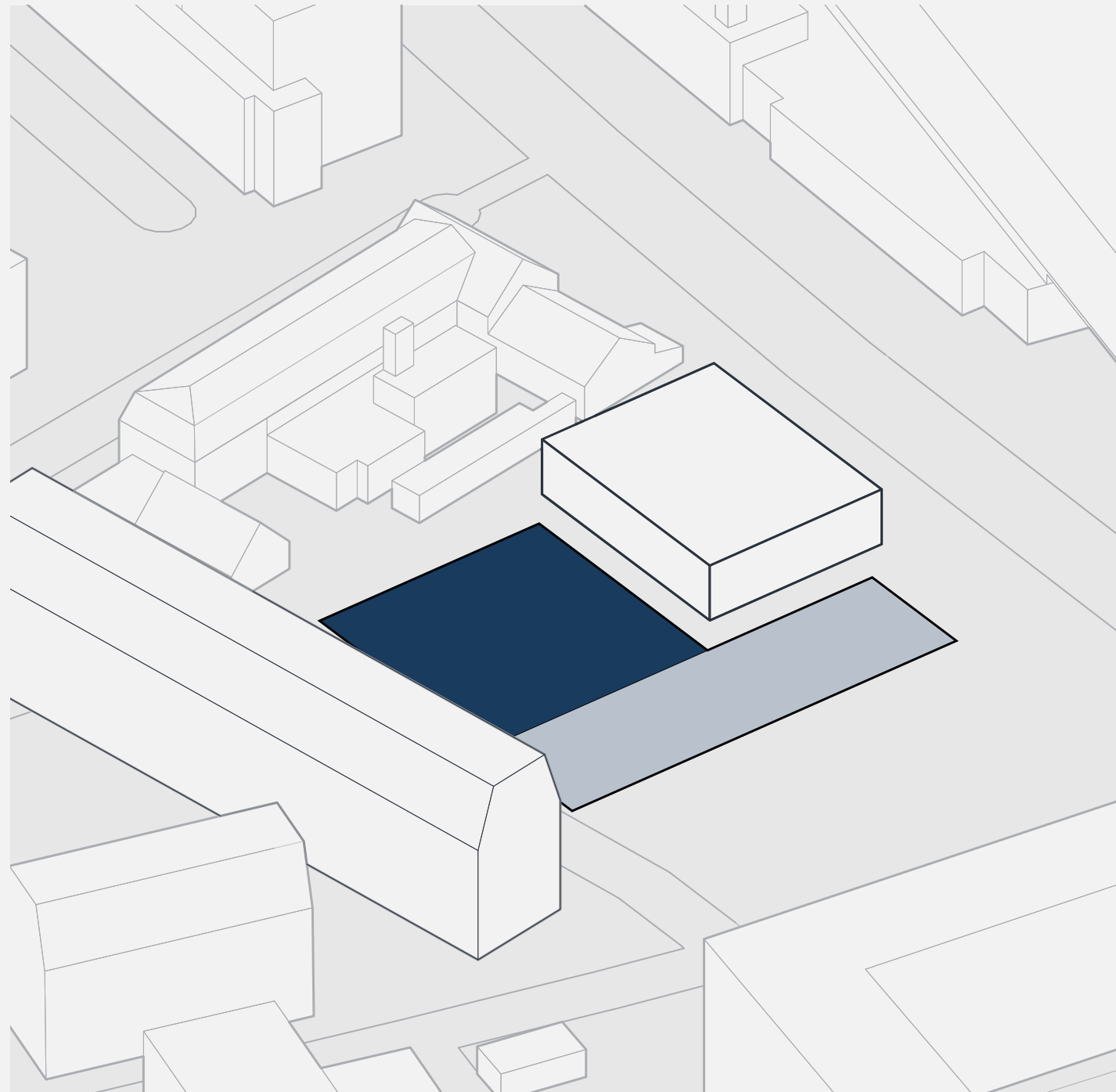
- Multipurpose hall & Corridor
- Adaption with existing Grocer
- Double height spaces



MASSING

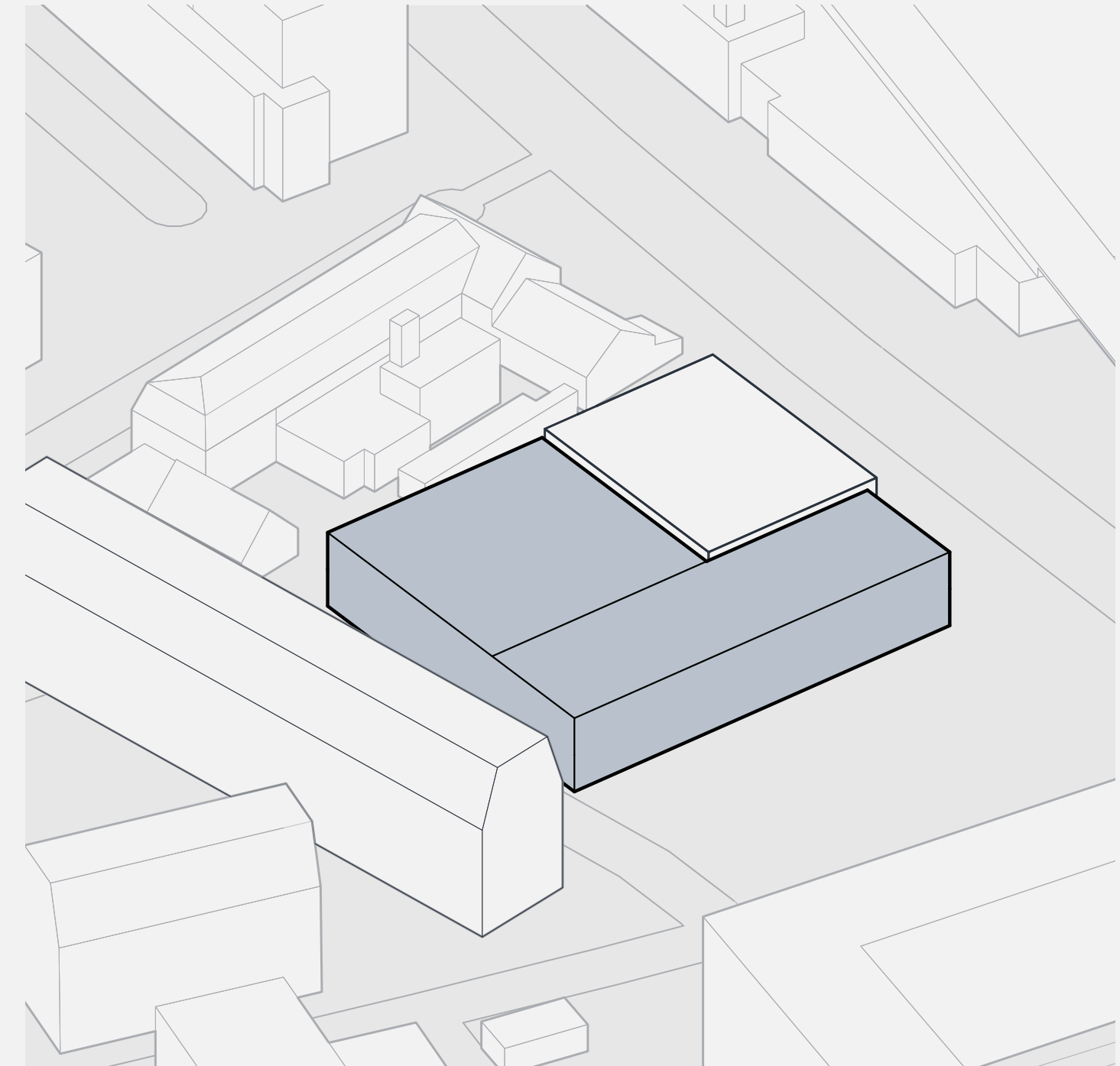
STEP 1

Organizing corridor and back of house



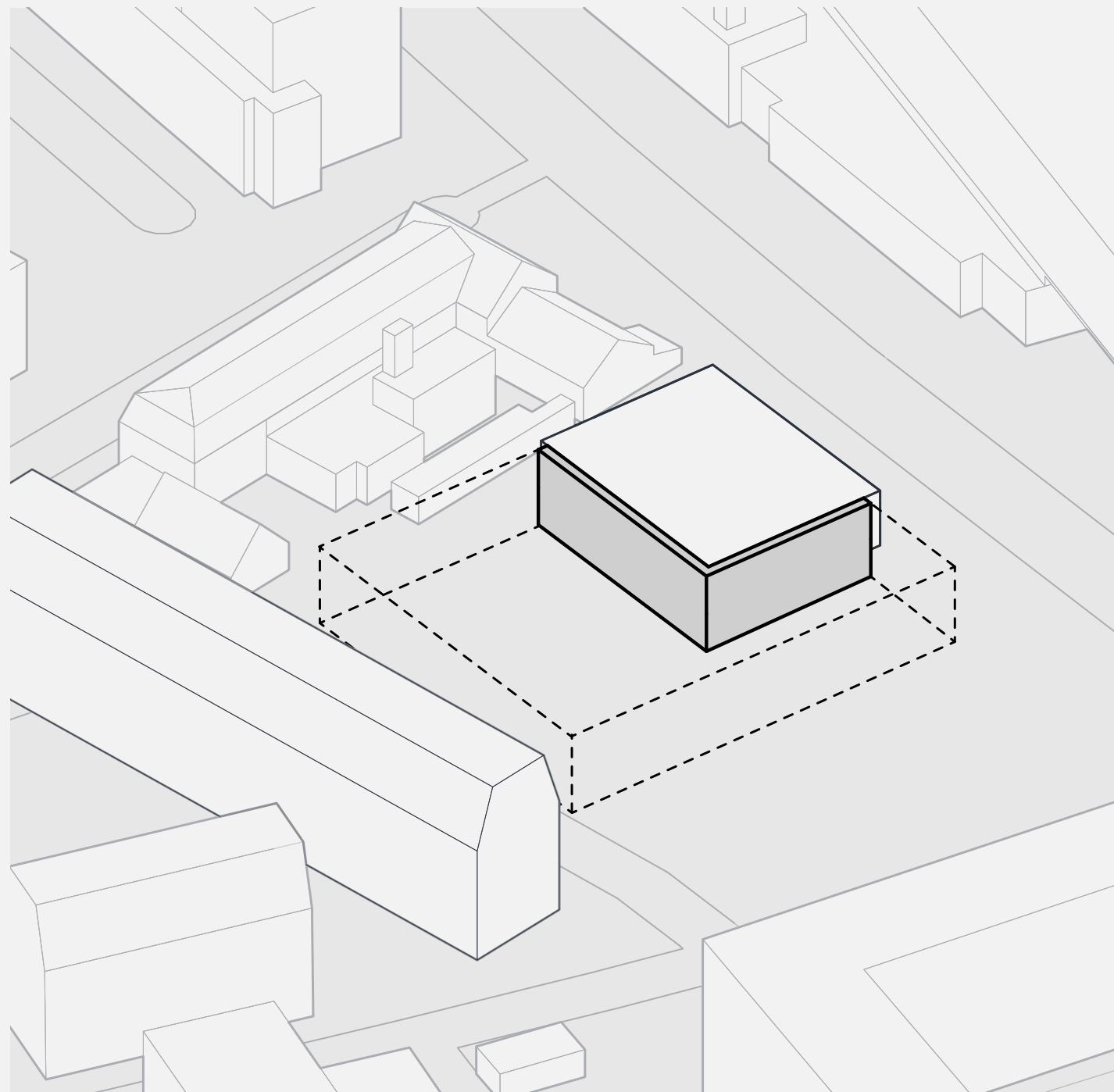
STEP 2

Placement of basement



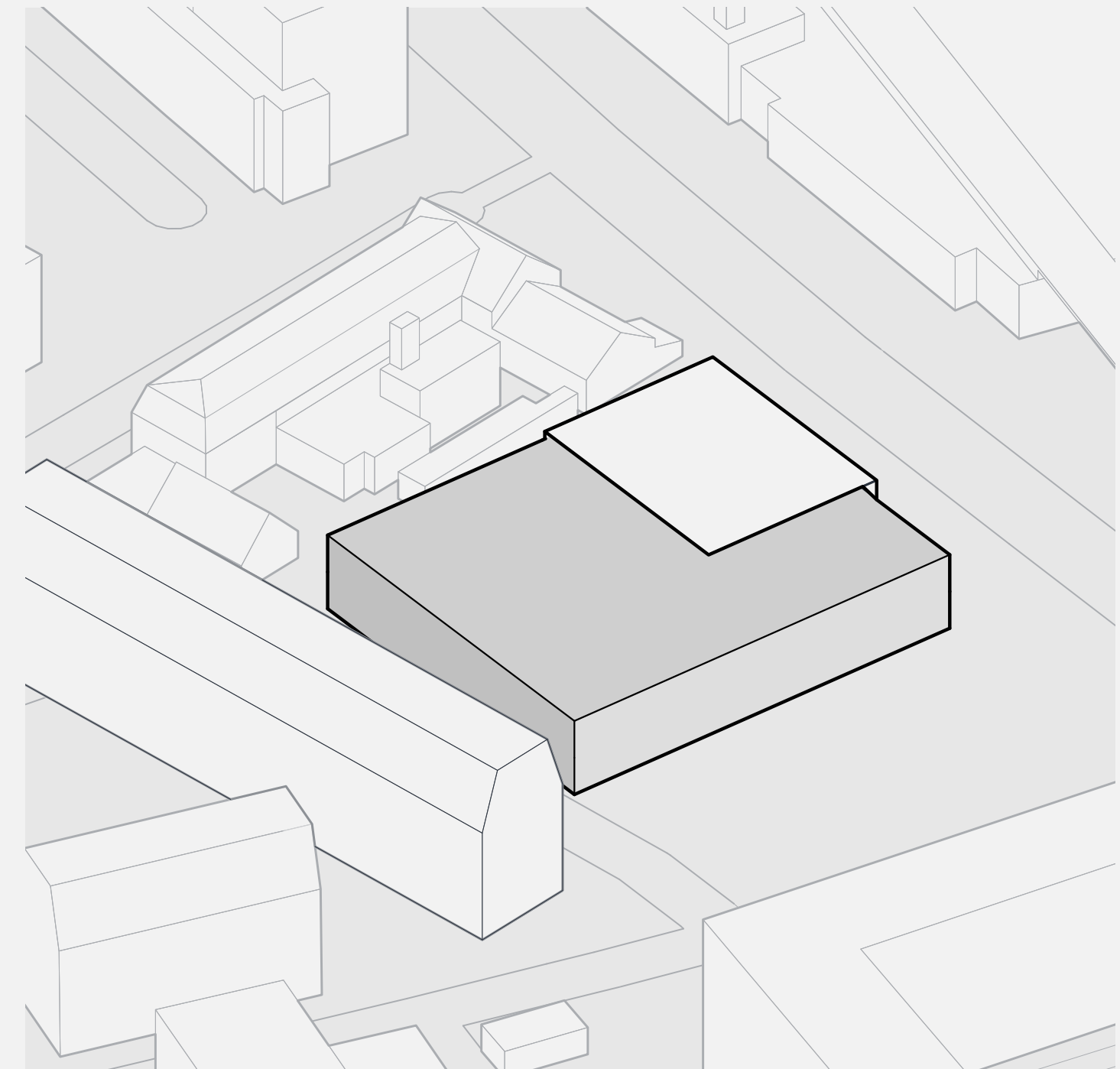
STEP 3

Connection with existing Lygten Bazar



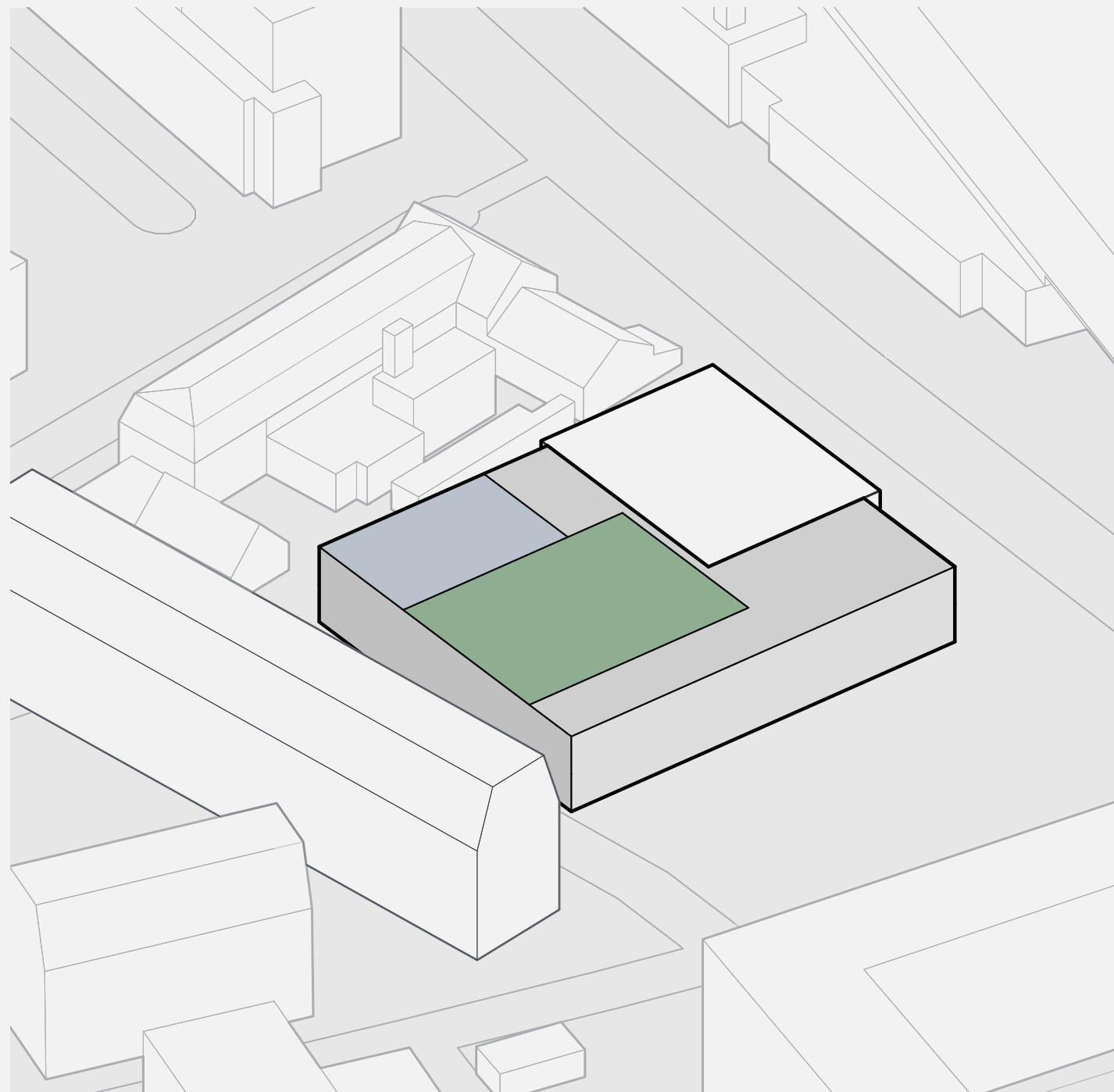
STEP 4

Basement connected with Lygten Bazar



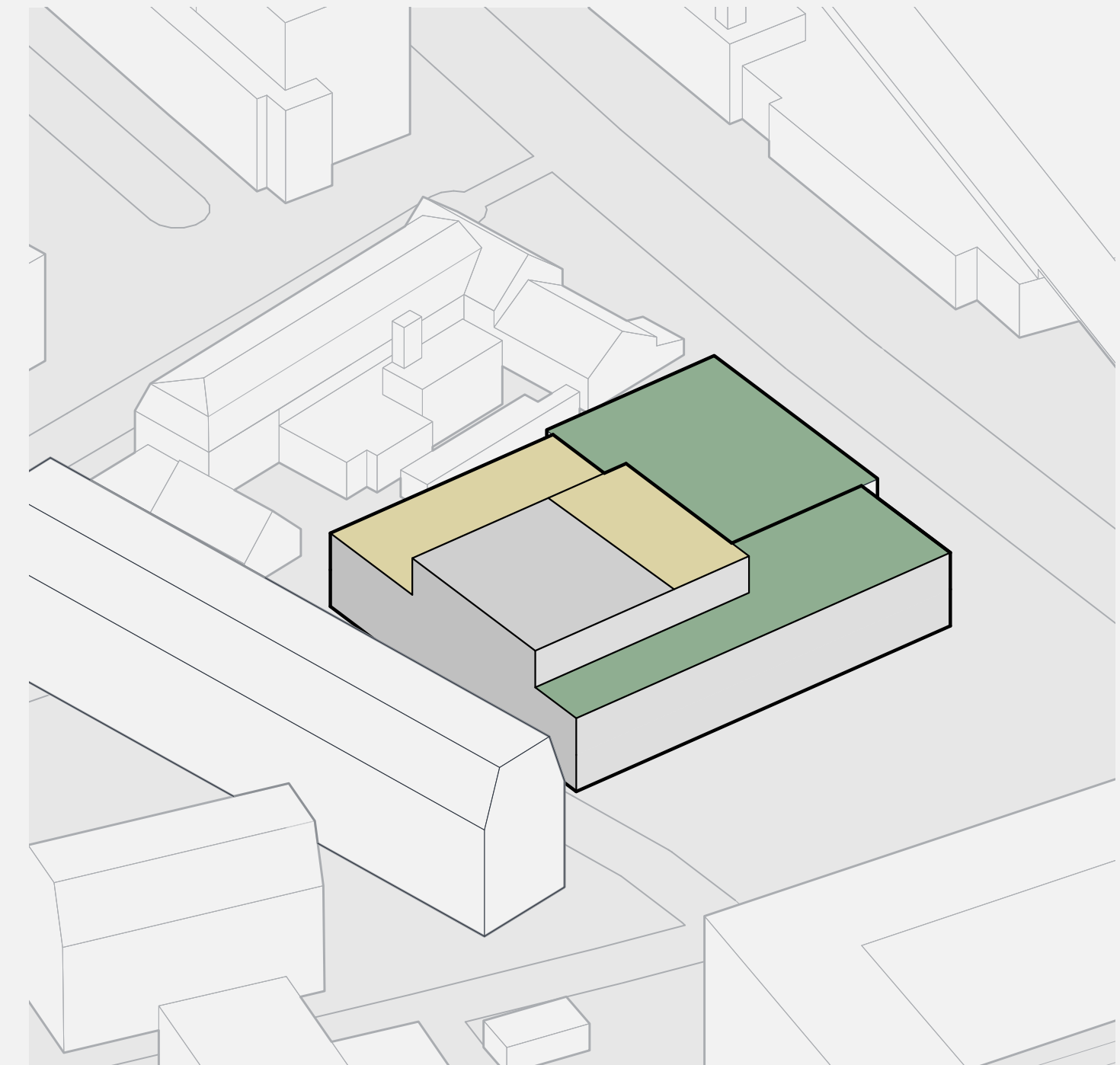
STEP 5

Multipurpose hall separate from tower



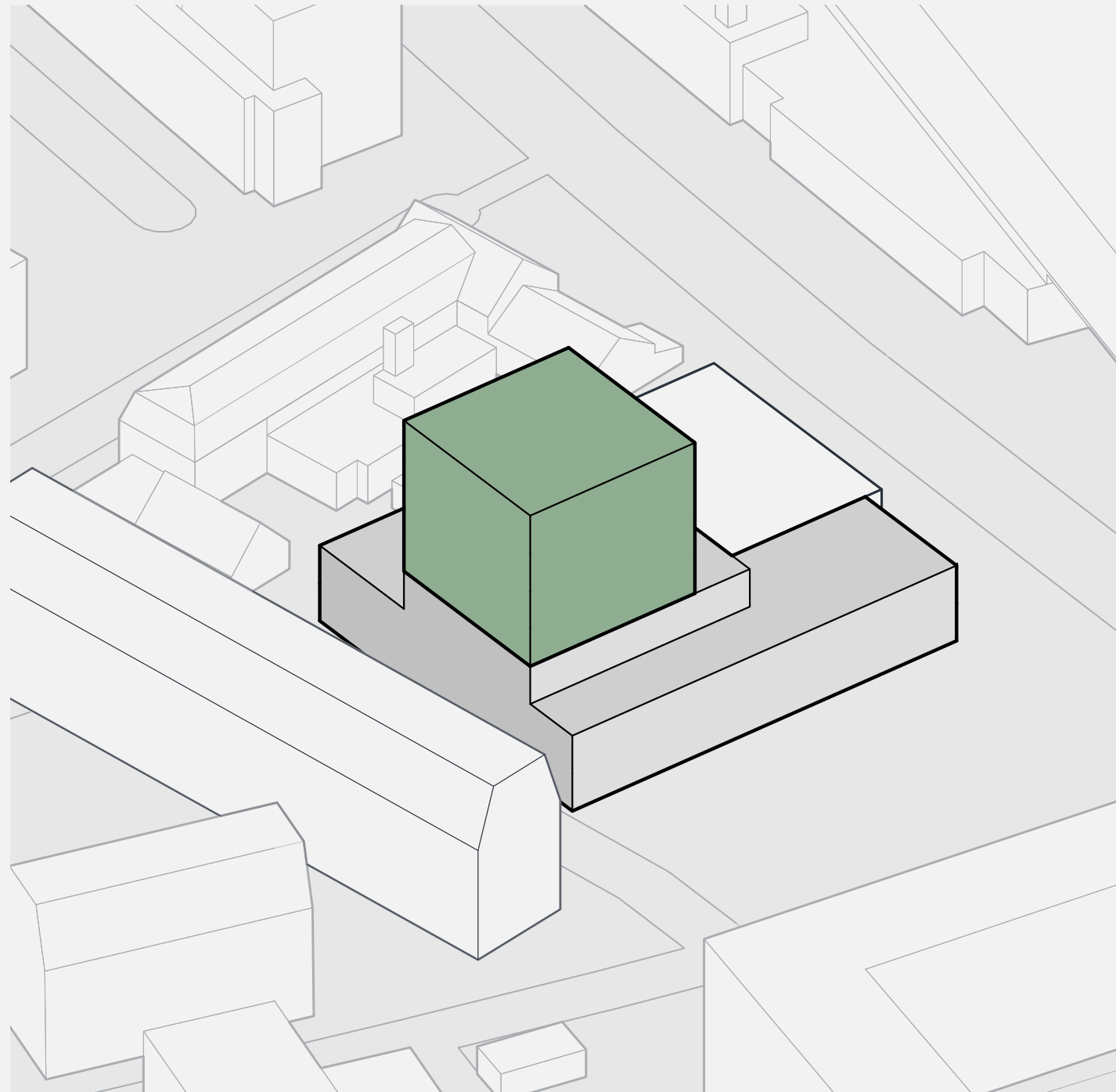
STEP 6

Dividing urban agriculture (yellow) & biodiversity roofs (Green)



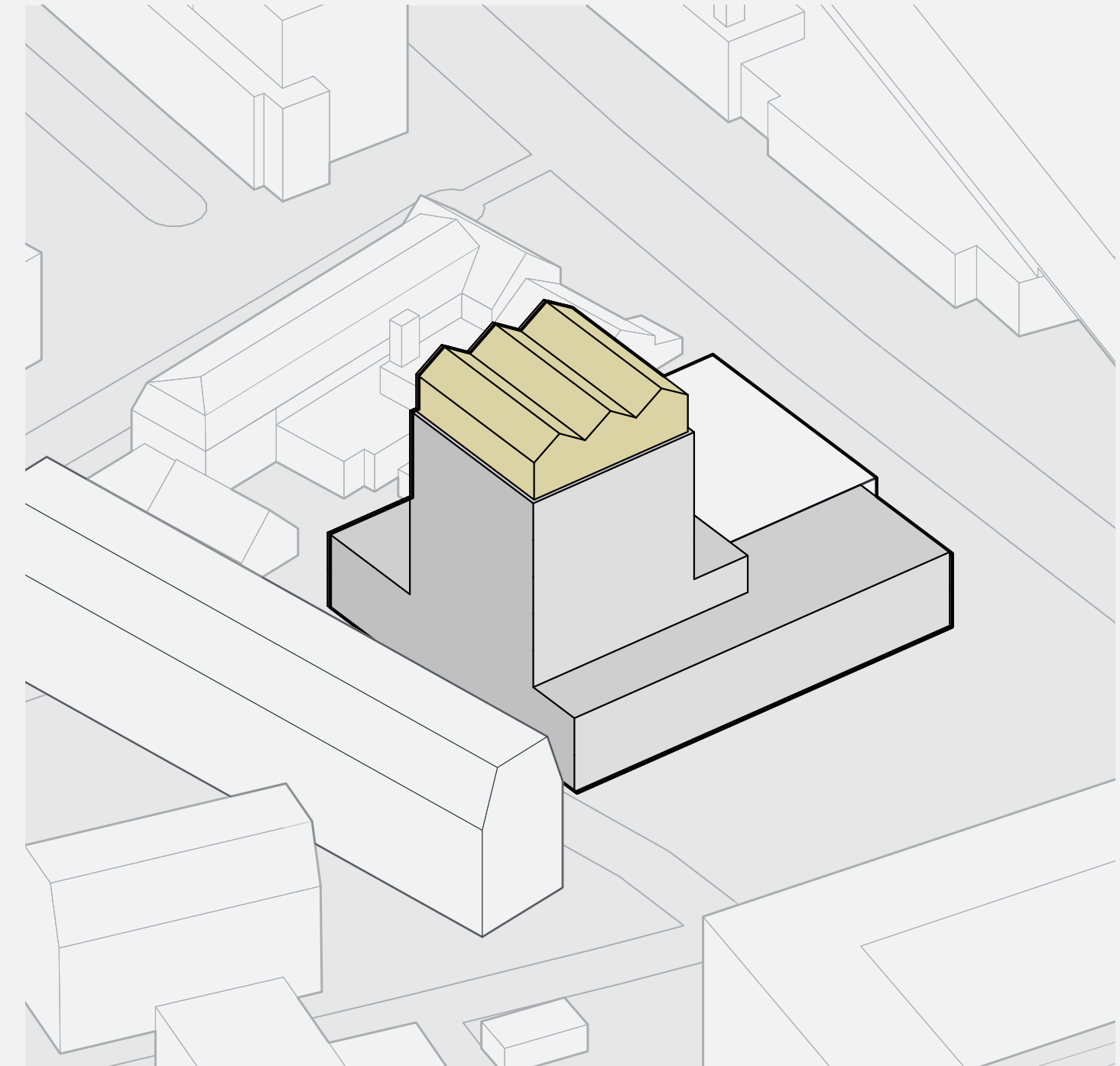
STEP 7

Placement of body



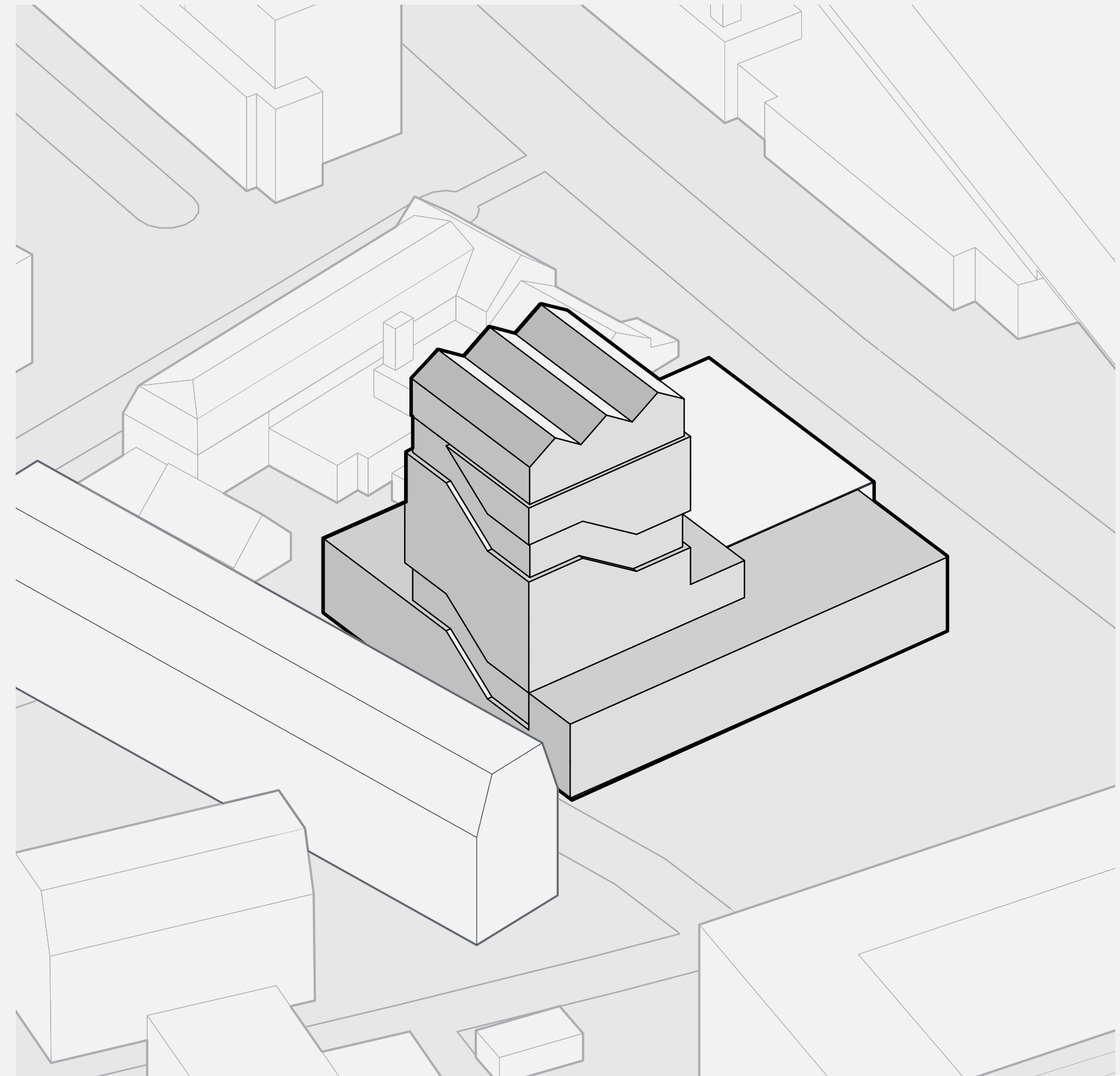
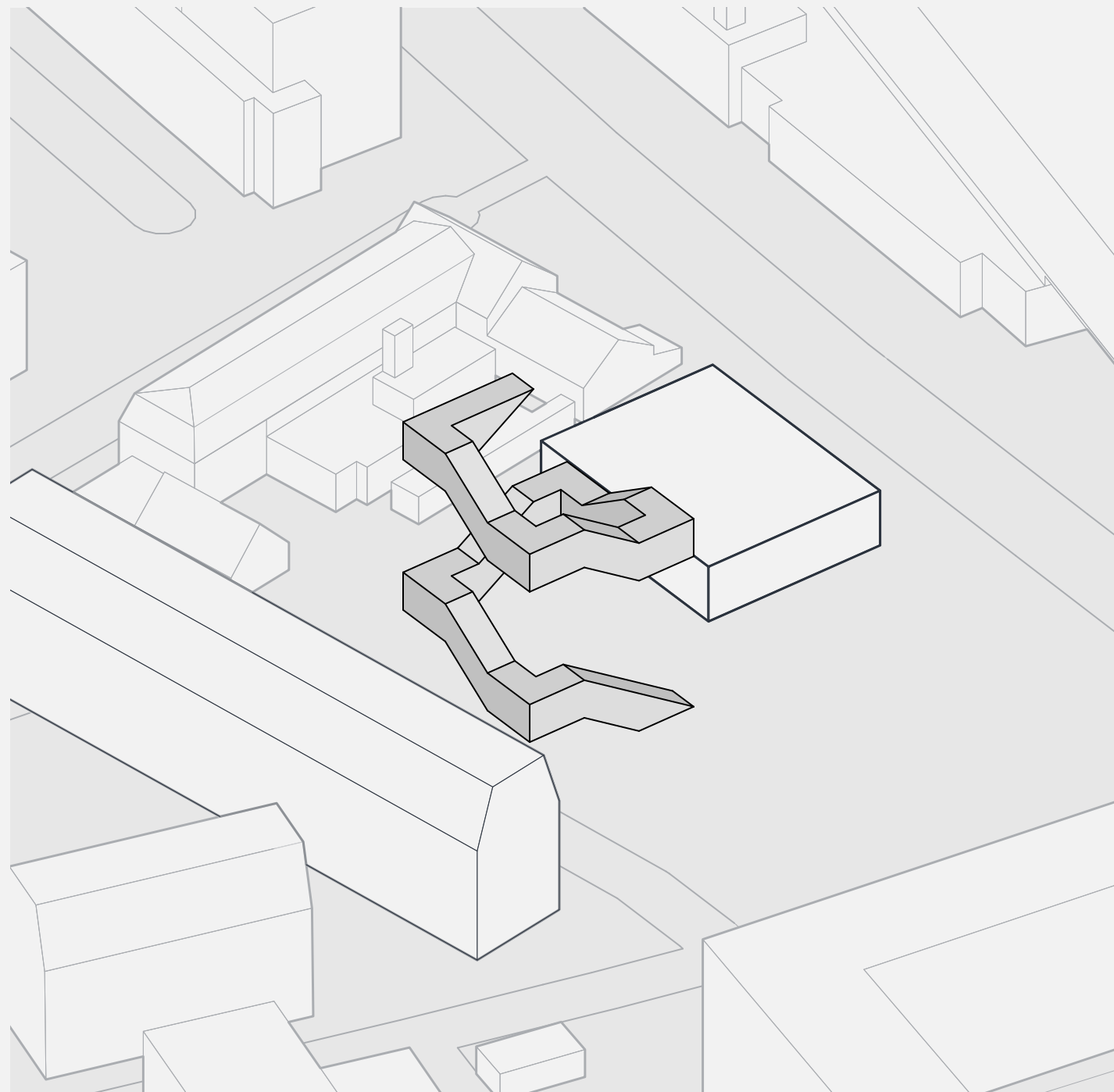
STEP 8

Placement of crown



STEP 9

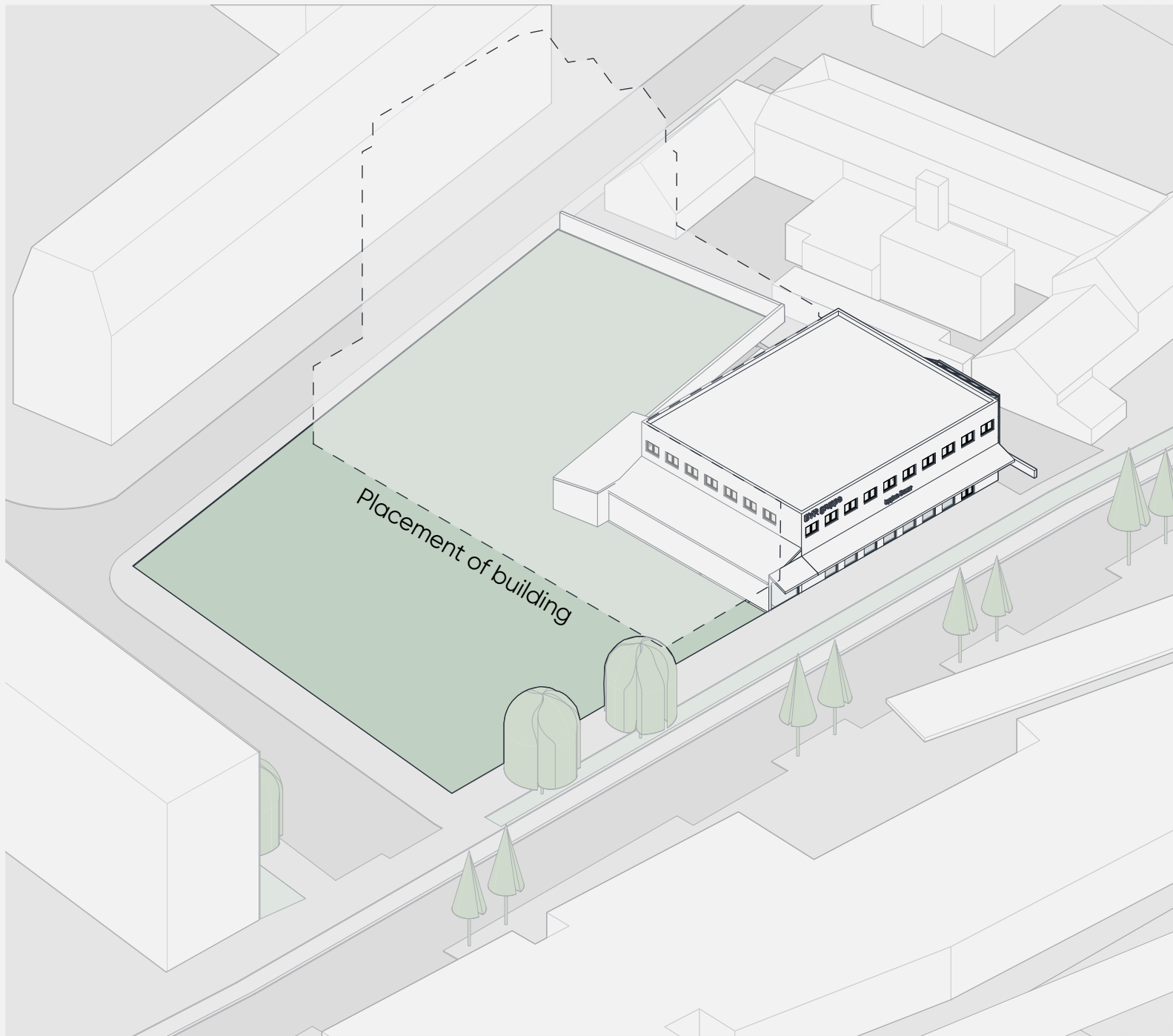
Adding of urban agriculture throughout building



LANDSCAPE

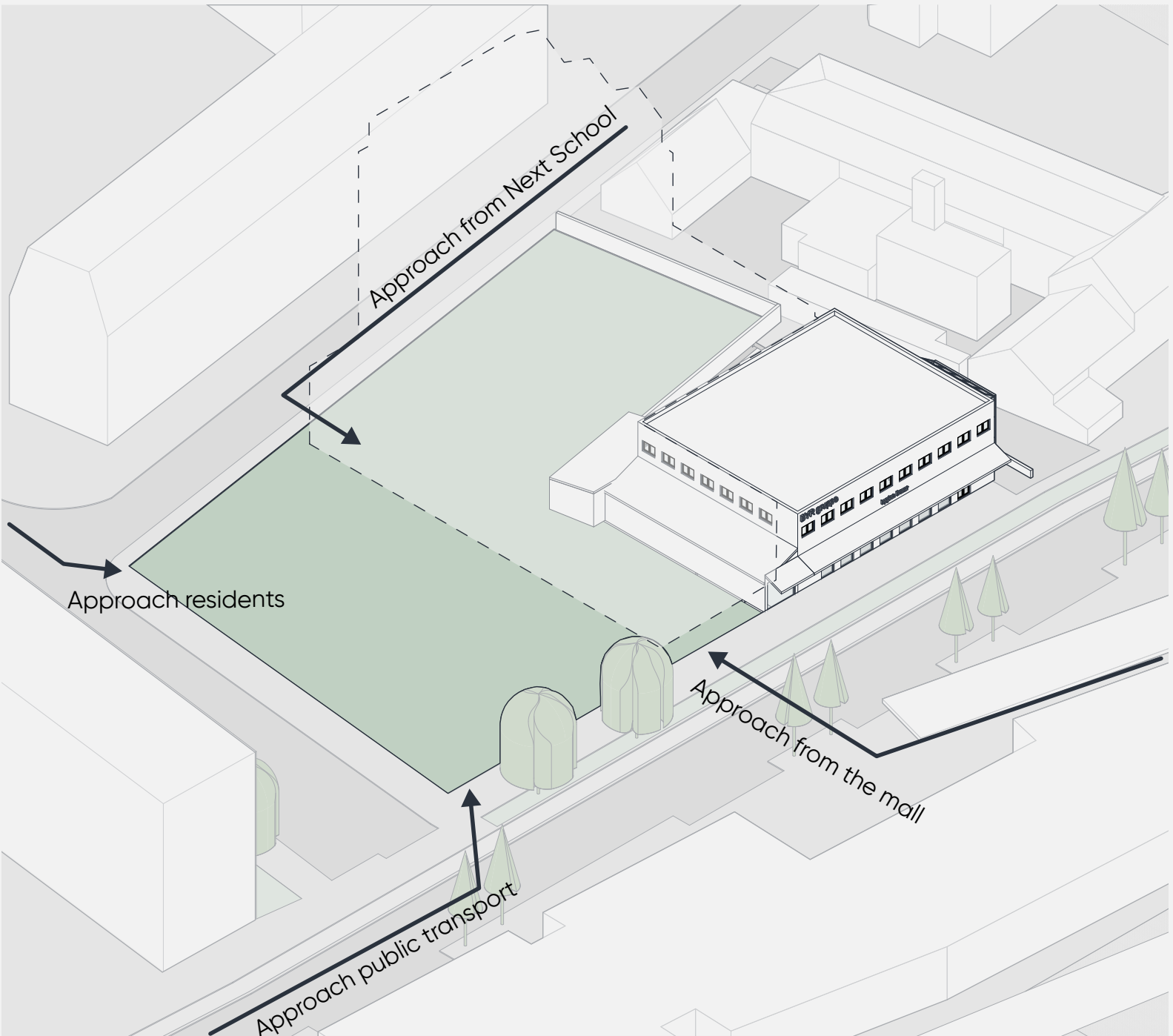
STEP 1

Placement of building



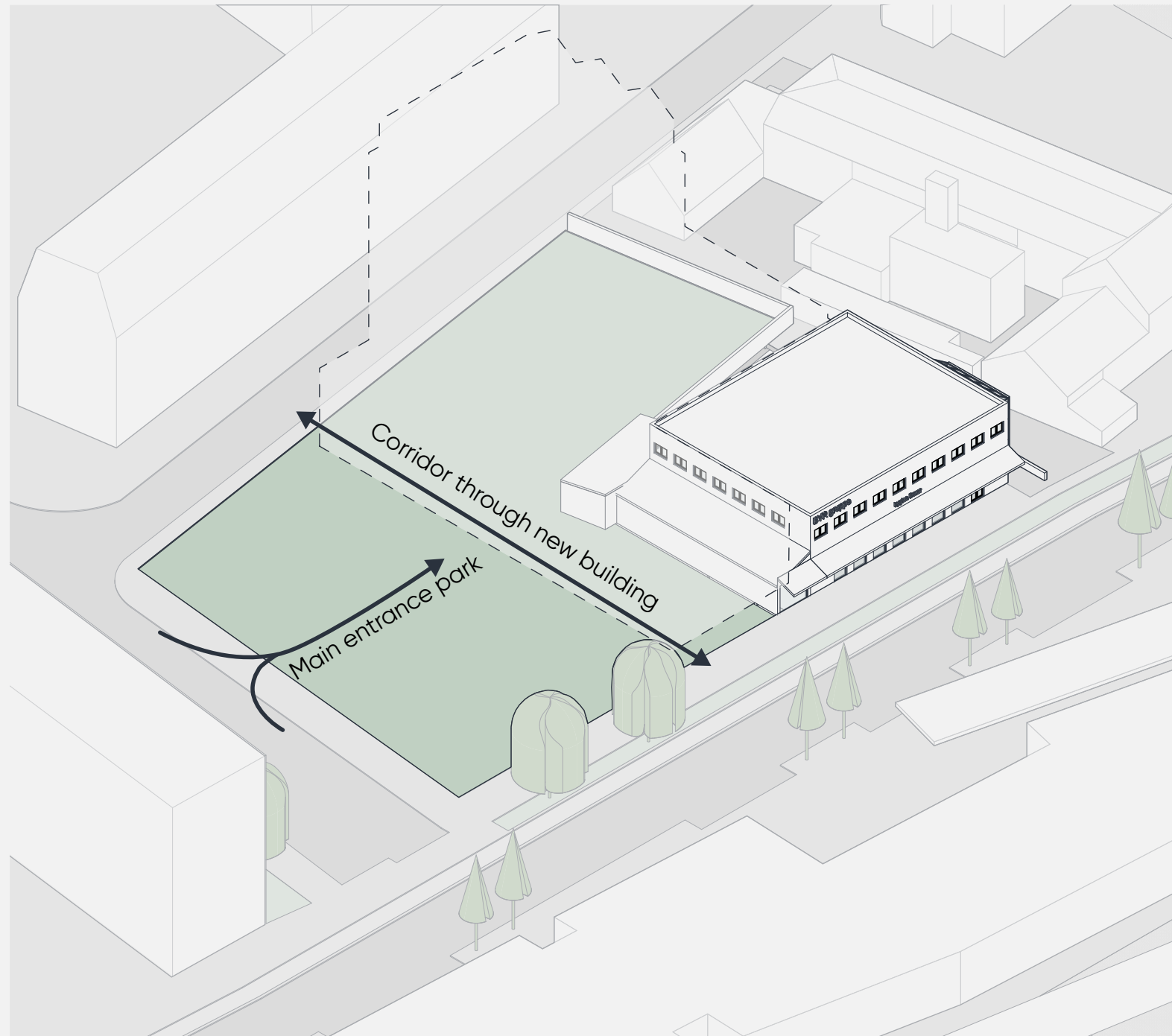
STEP 2

Approaches to the site



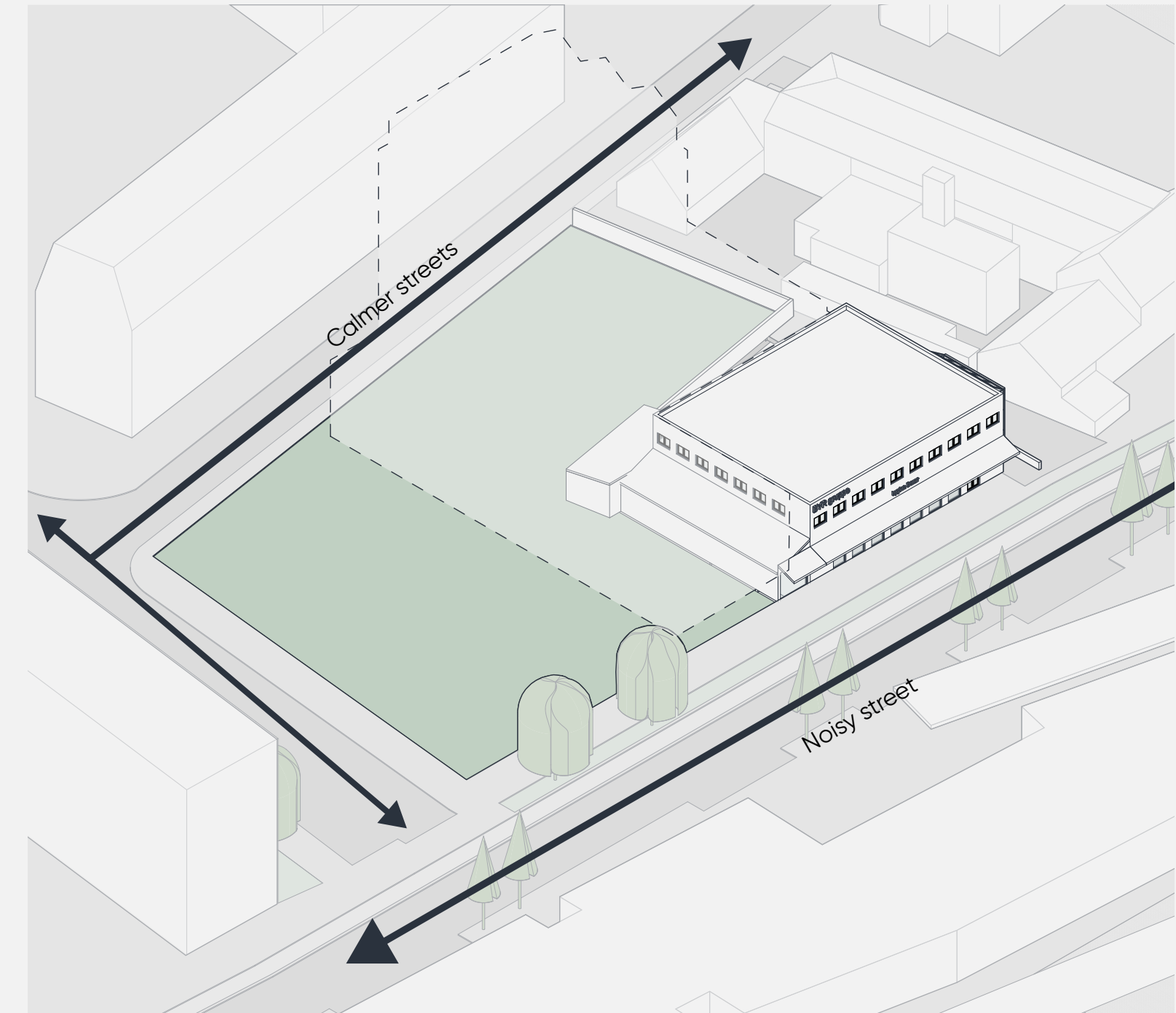
STEP 3

Corridor and main entrance for the park



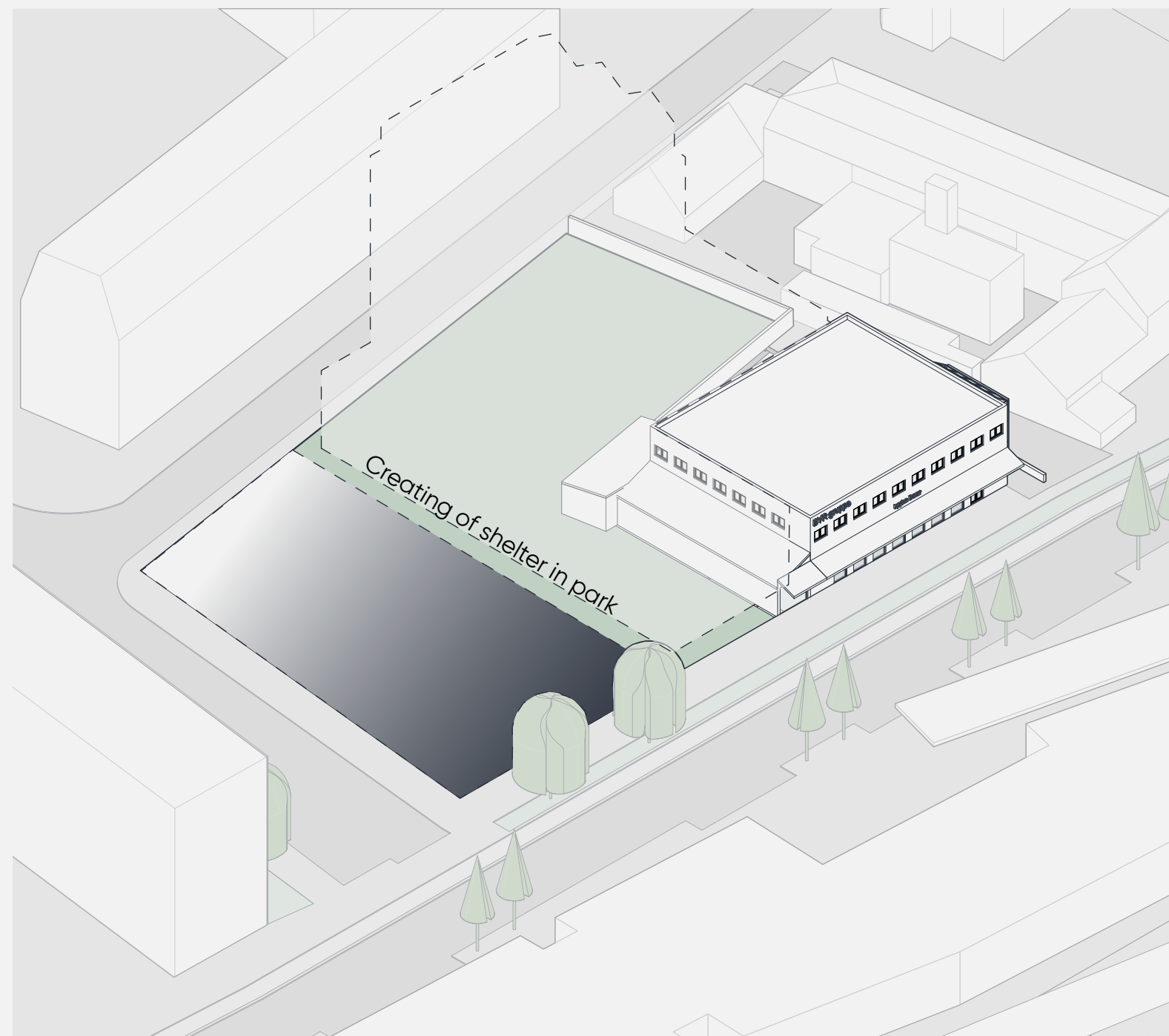
STEP 4

Noisy and calmer street influence the park



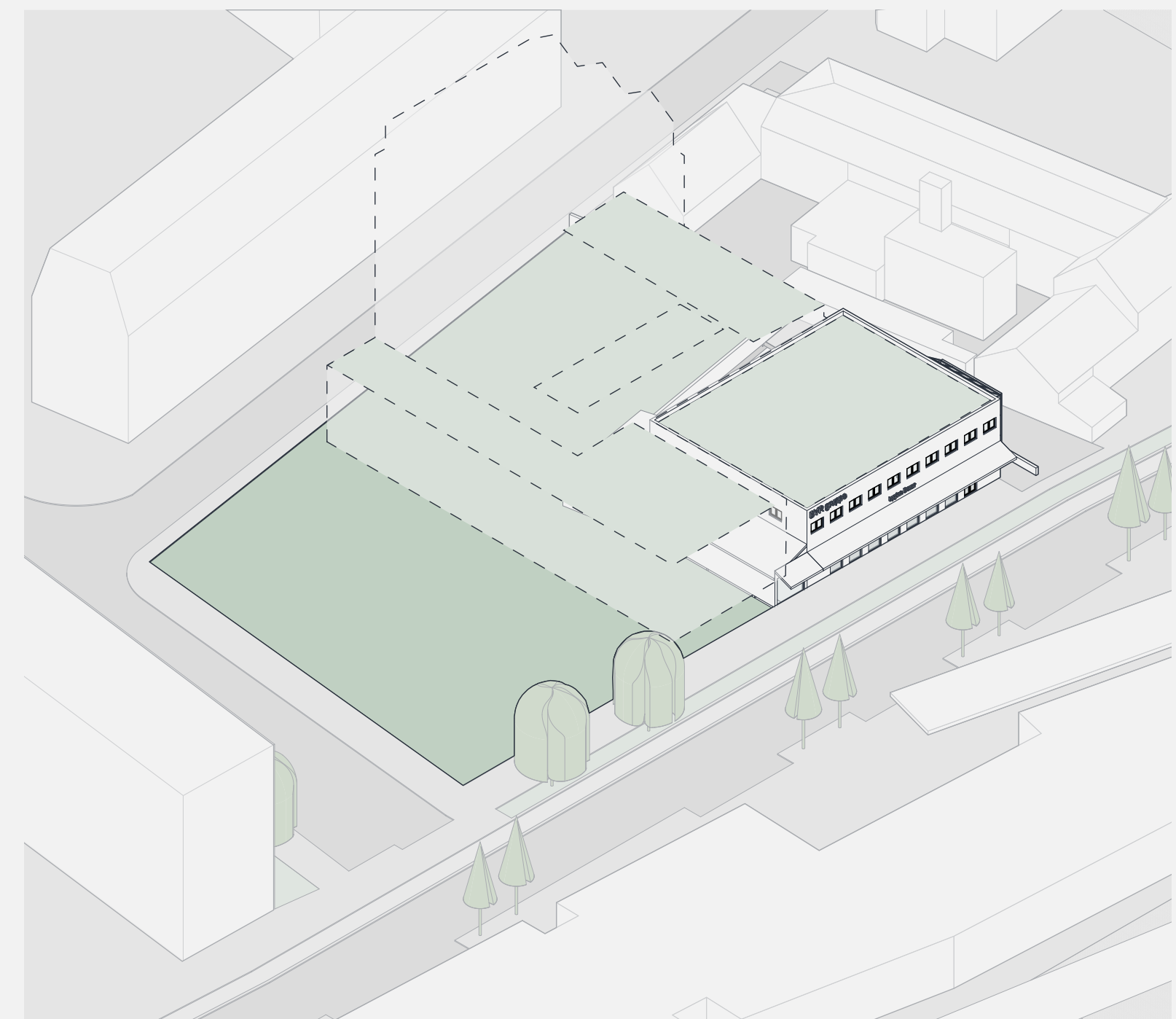
STEP 5

Creating of shelter in the park from busy street



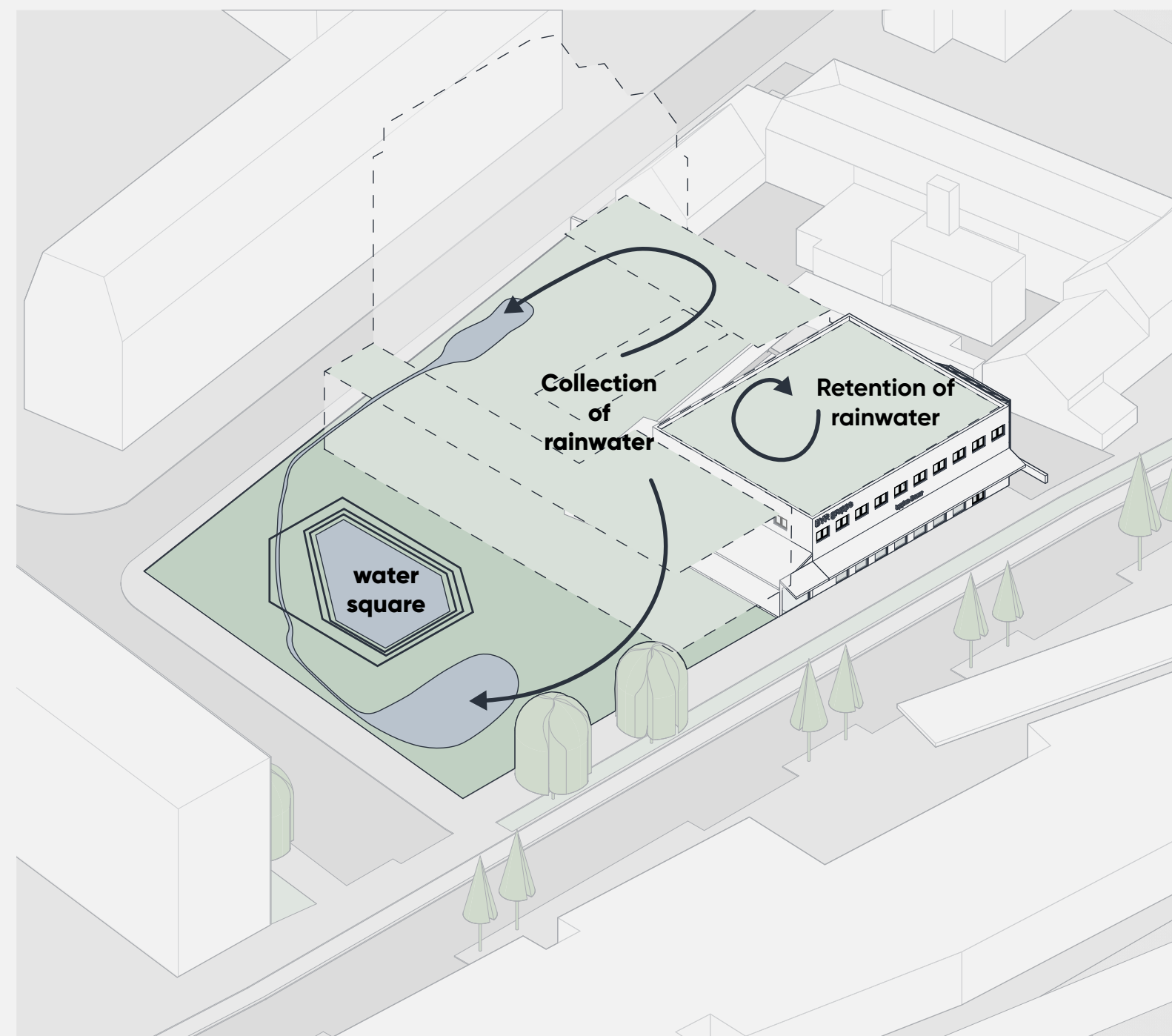
STEP 6

Recognizing roofs for water storage potential



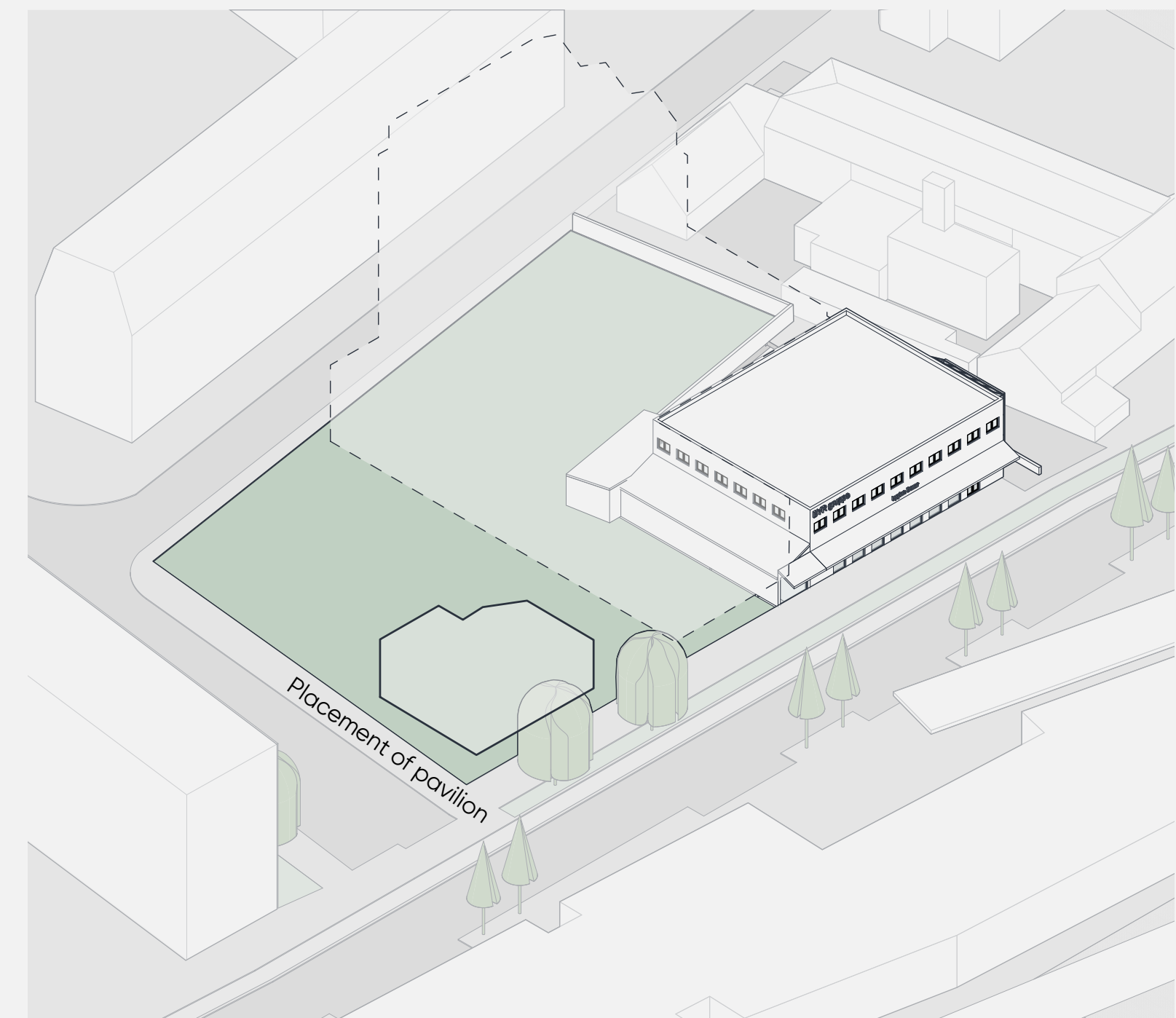
STEP 7

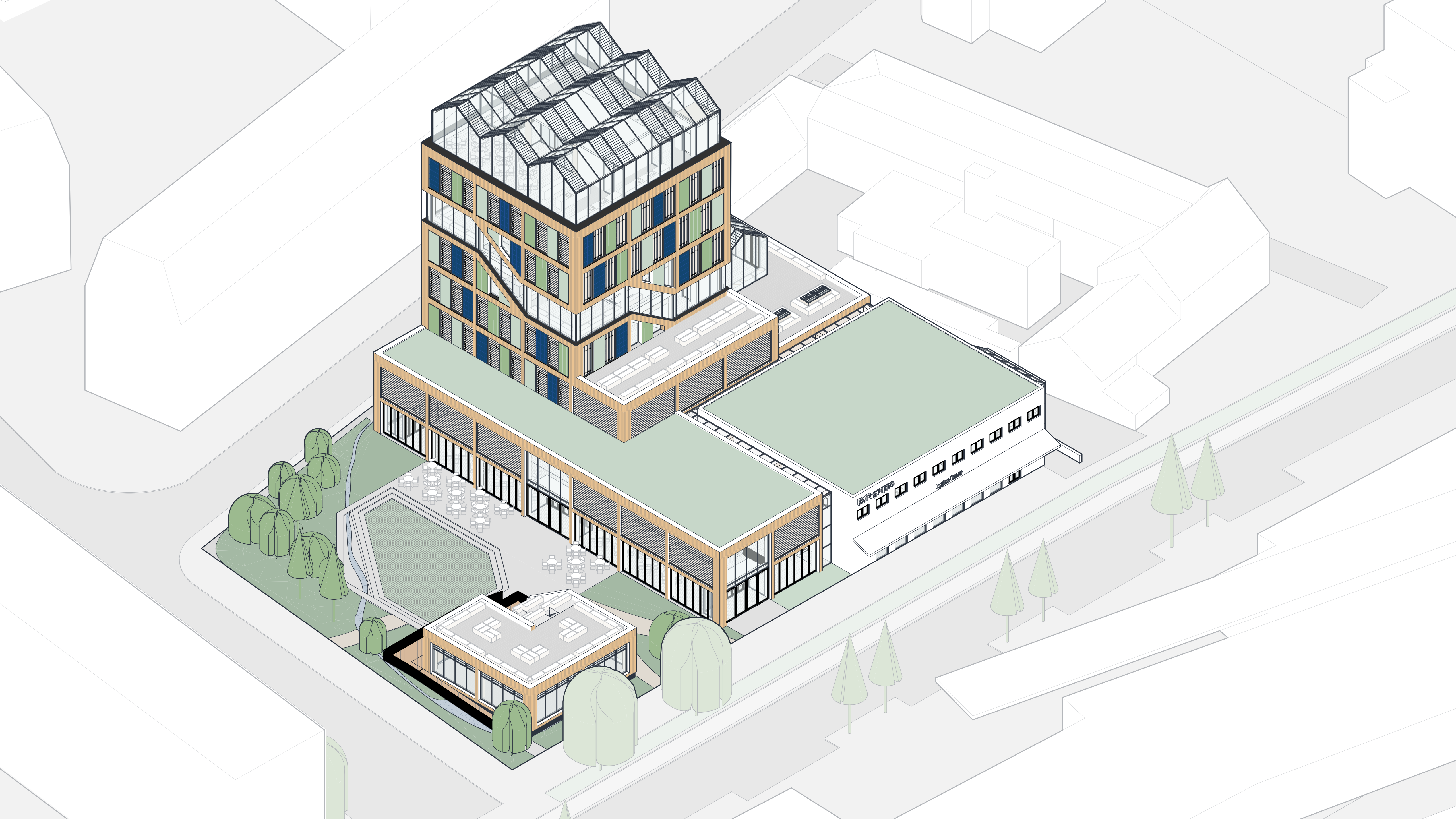
Roofscape as part of waterscape in the park



STEP 8

Placement of pavilion in the park







Homeless
Shelter

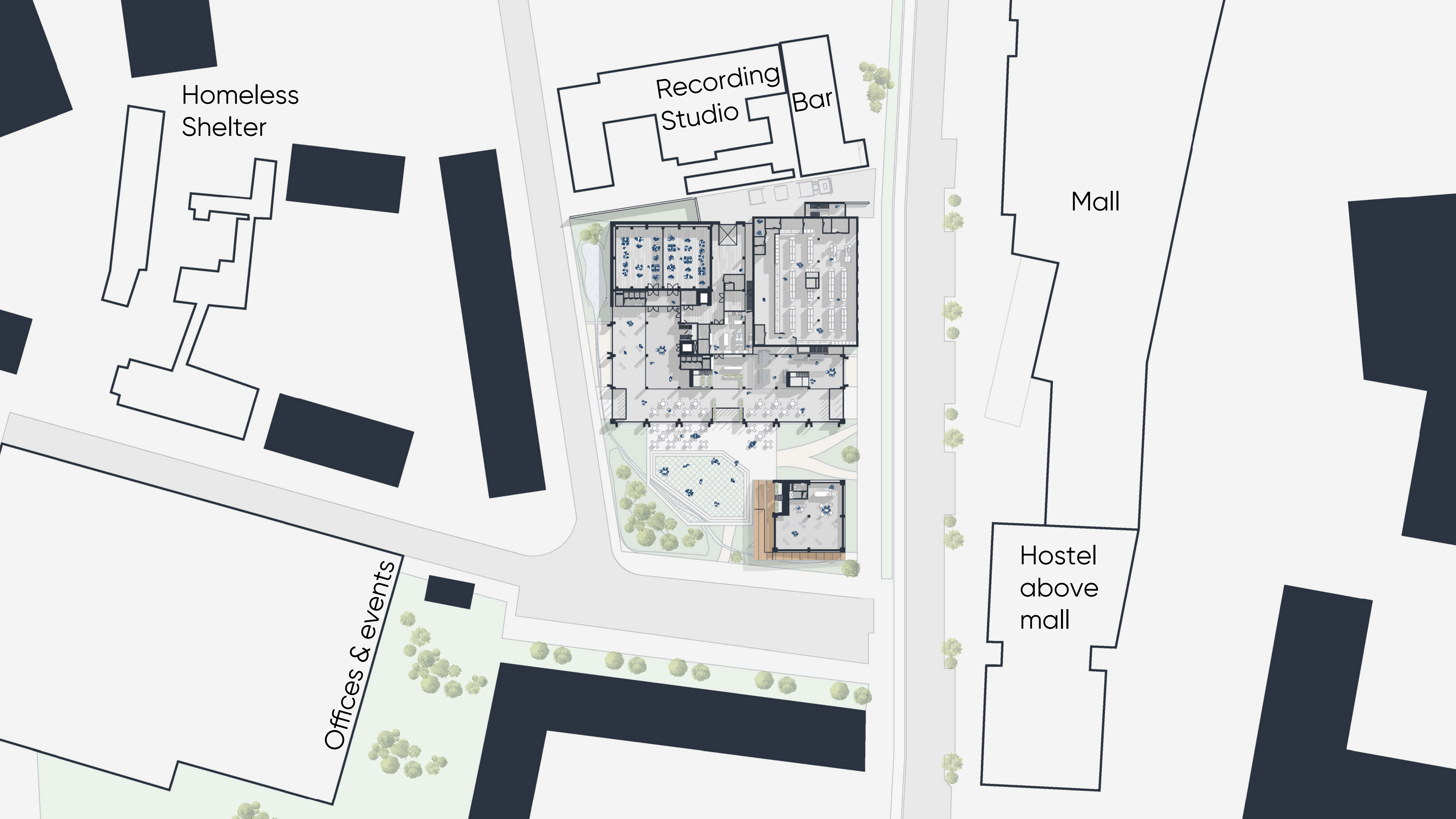
Recording
Studio

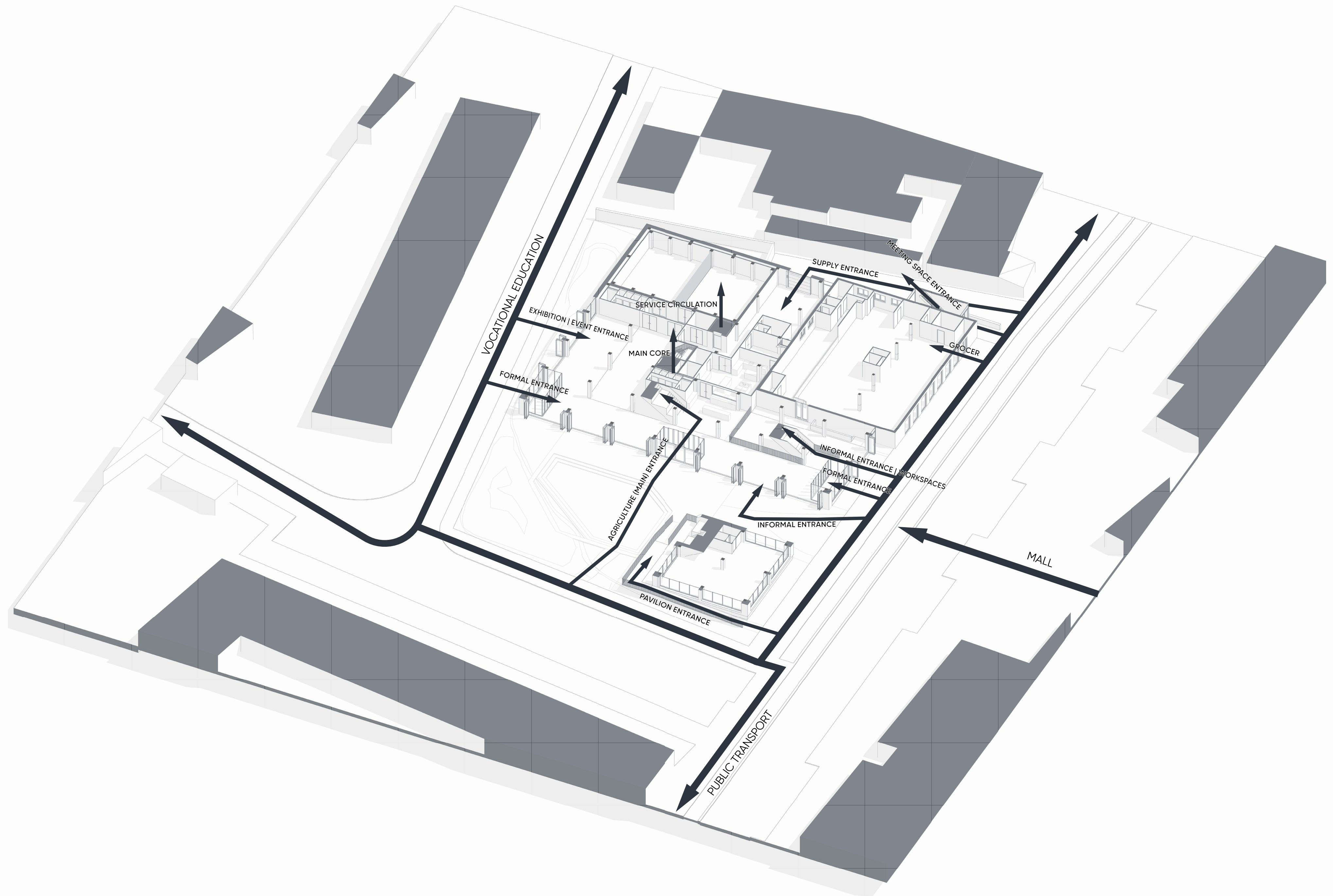
Bar

Mall

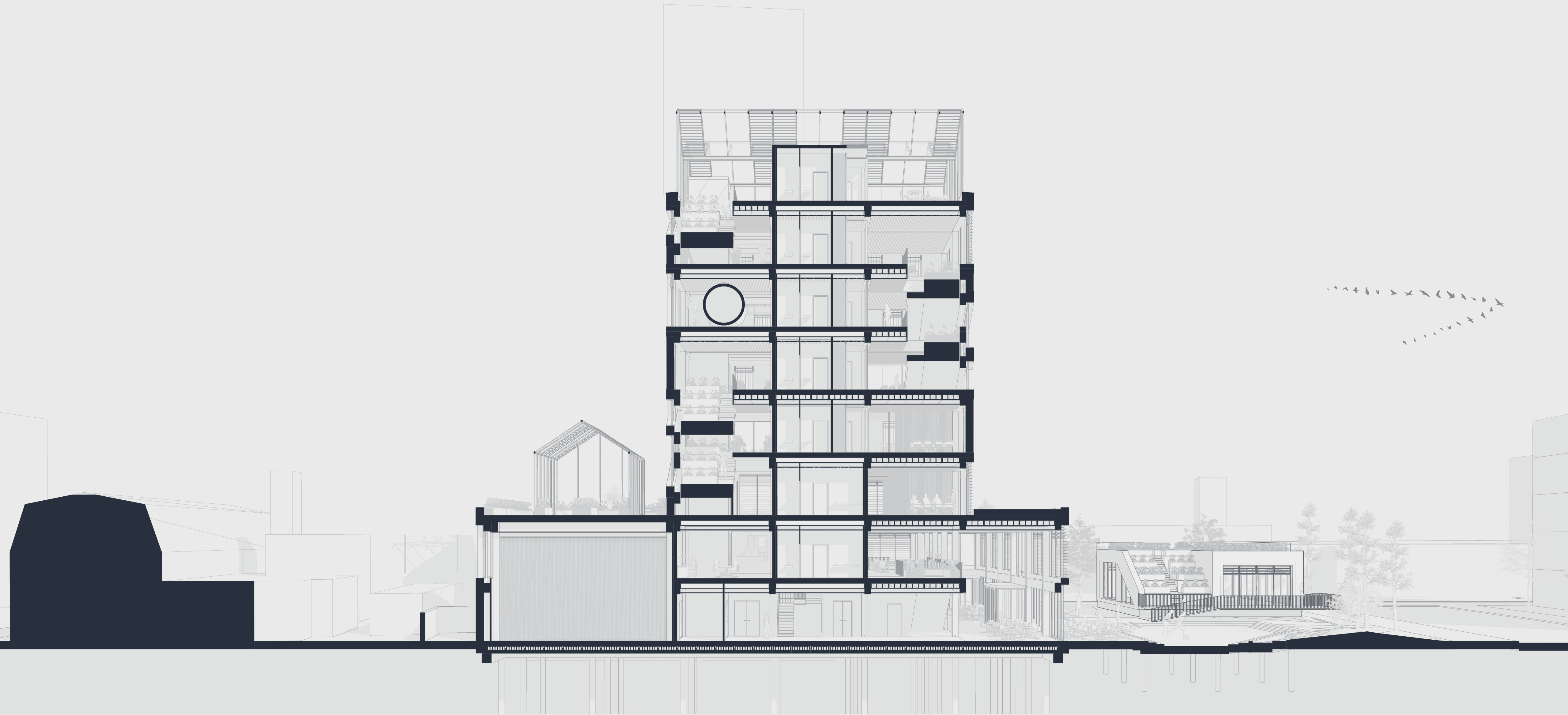
Hostel
above
mall

Offices & events









FUNCTIONS

Attractive functions

- Multipurpose hall
- Grocery store
- Restaurant
- Workspaces
- Meeting spaces
- Rooftop bar

Sustainable functions

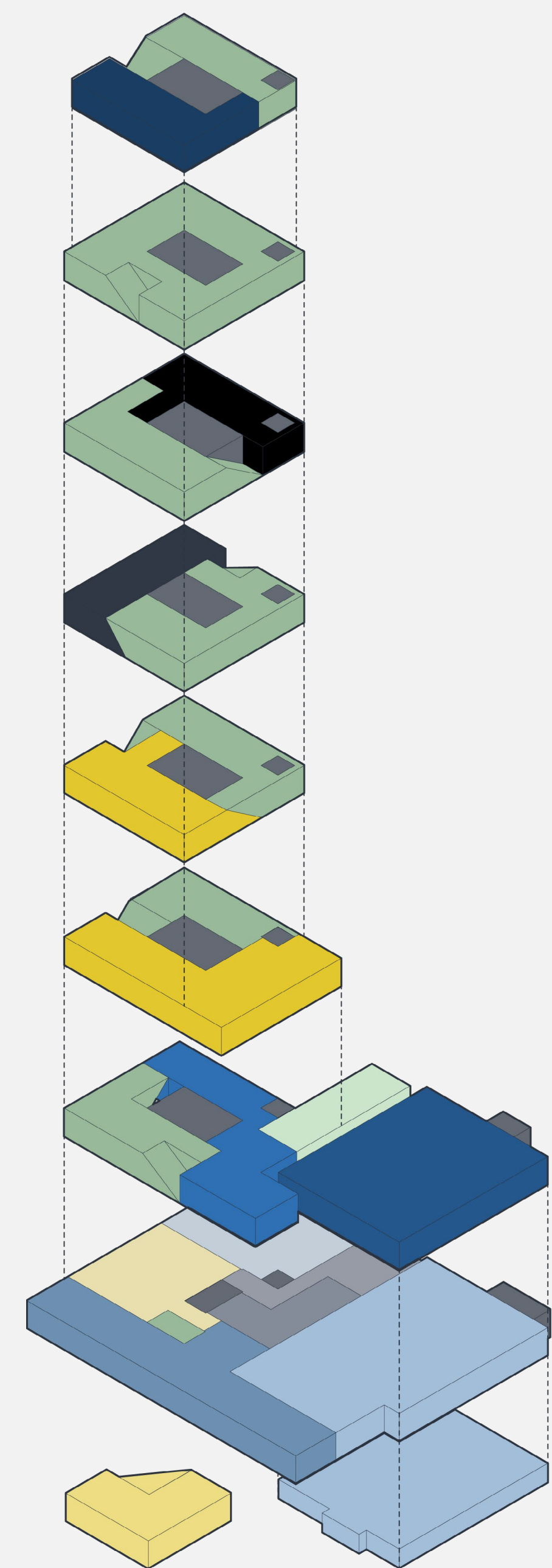
- Repair café
- Urban agriculture

Encouraging functions

- Foyer / exhibition
- Pavilion
- Educational facilities

Auxiliary functions

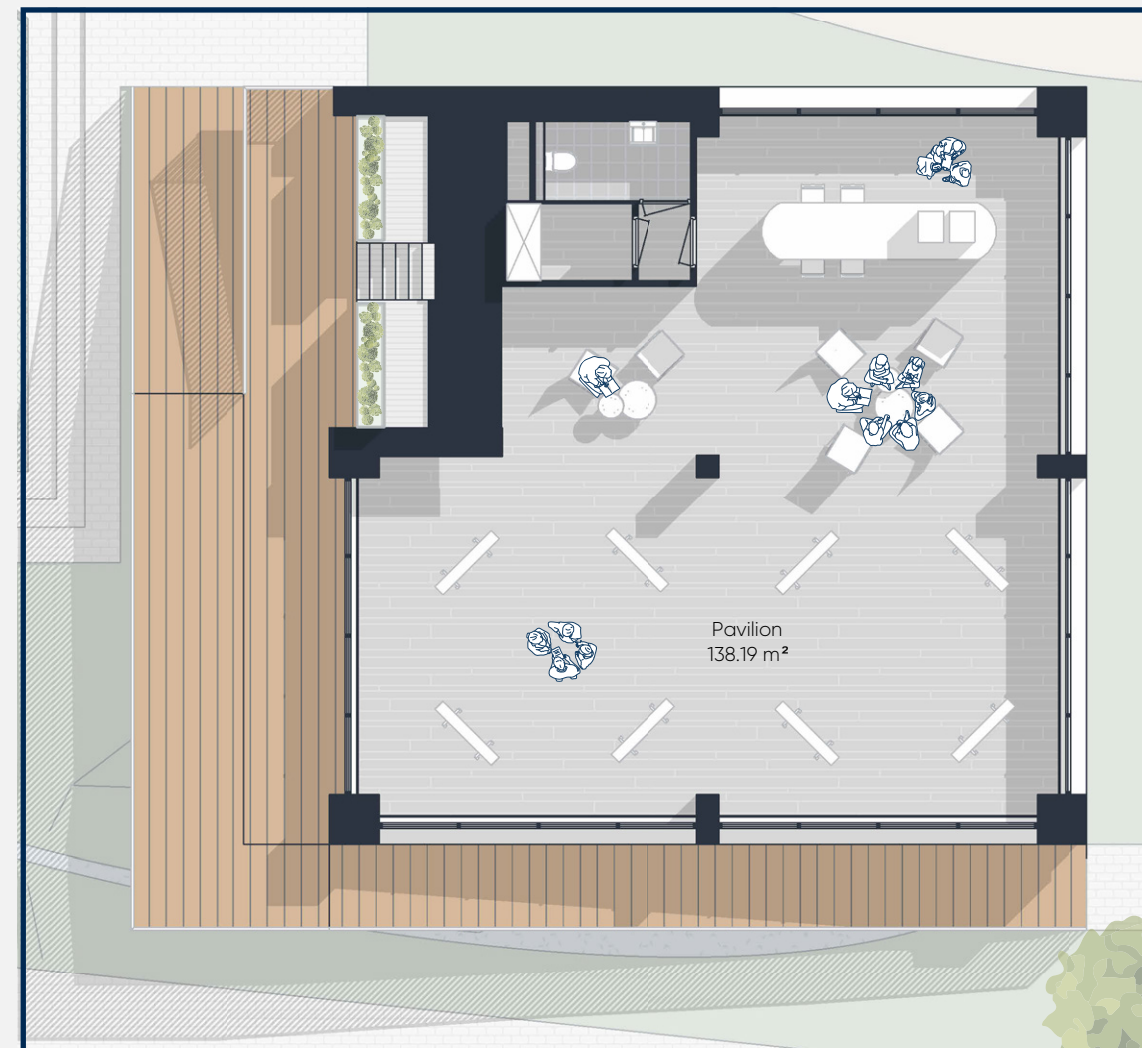
- Service entrance
- Kitchen
- Core & circulation
- Technical room
- Pyrolysis plant



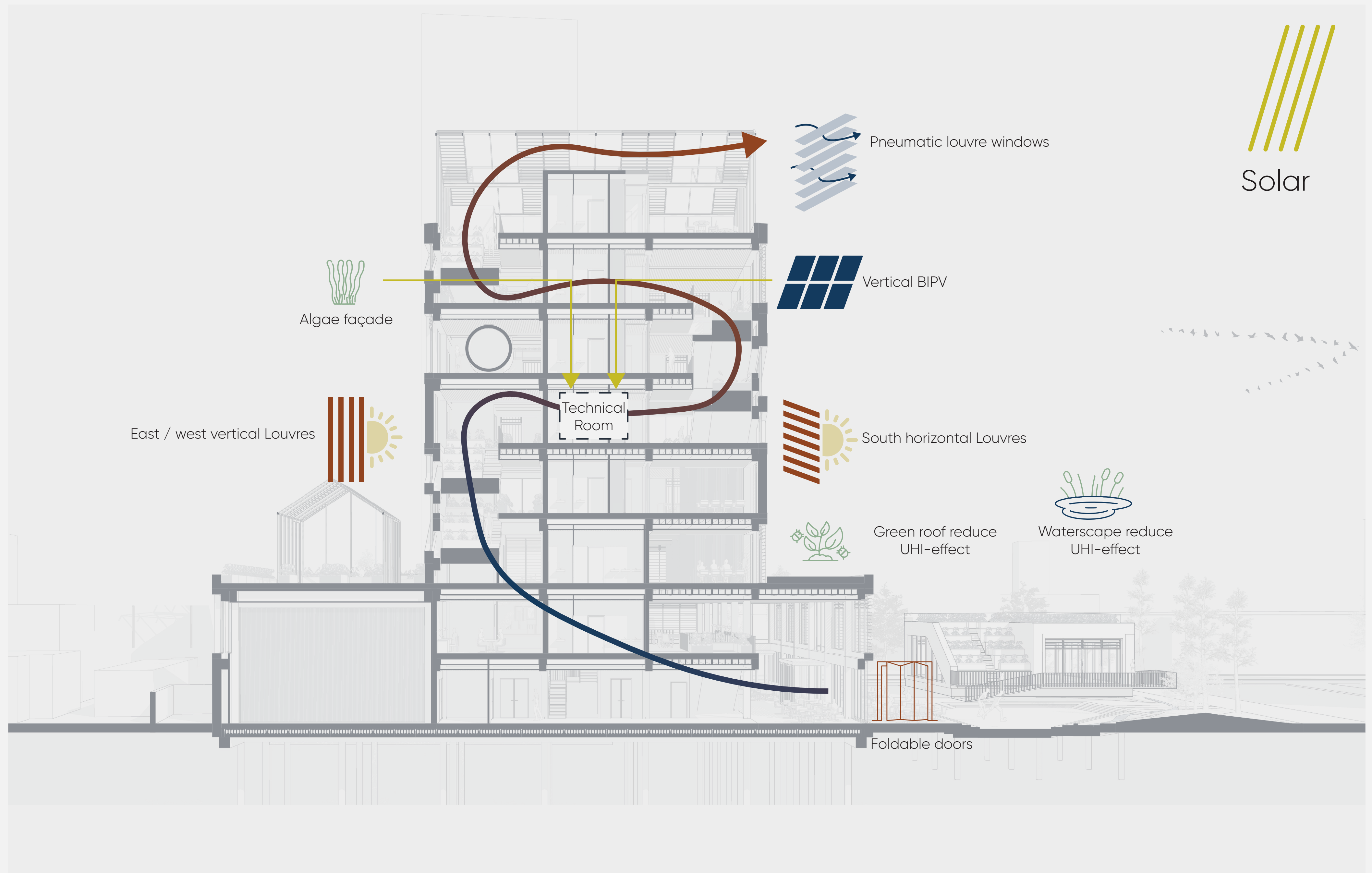
- 07 | Urban agriculture & rooftop bar
- 06 | Urban agriculture
- 05 | Pyrolysis plant & urban agriculture
- 04 | Technical room & urban agriculture
- 03 | Educational facilities & urban agriculture
- 02 | Educational facilities & urban agriculture
- 01 | Meeting-, workspaces & urban agriculture
- 00 | Public plinth & multipurpose hall
- 01 | Shopping underground

GROUND FLOOR

- Attractor of café & multipurpose hall
- Auxiliary functions
- Pavilion for information / exhibition





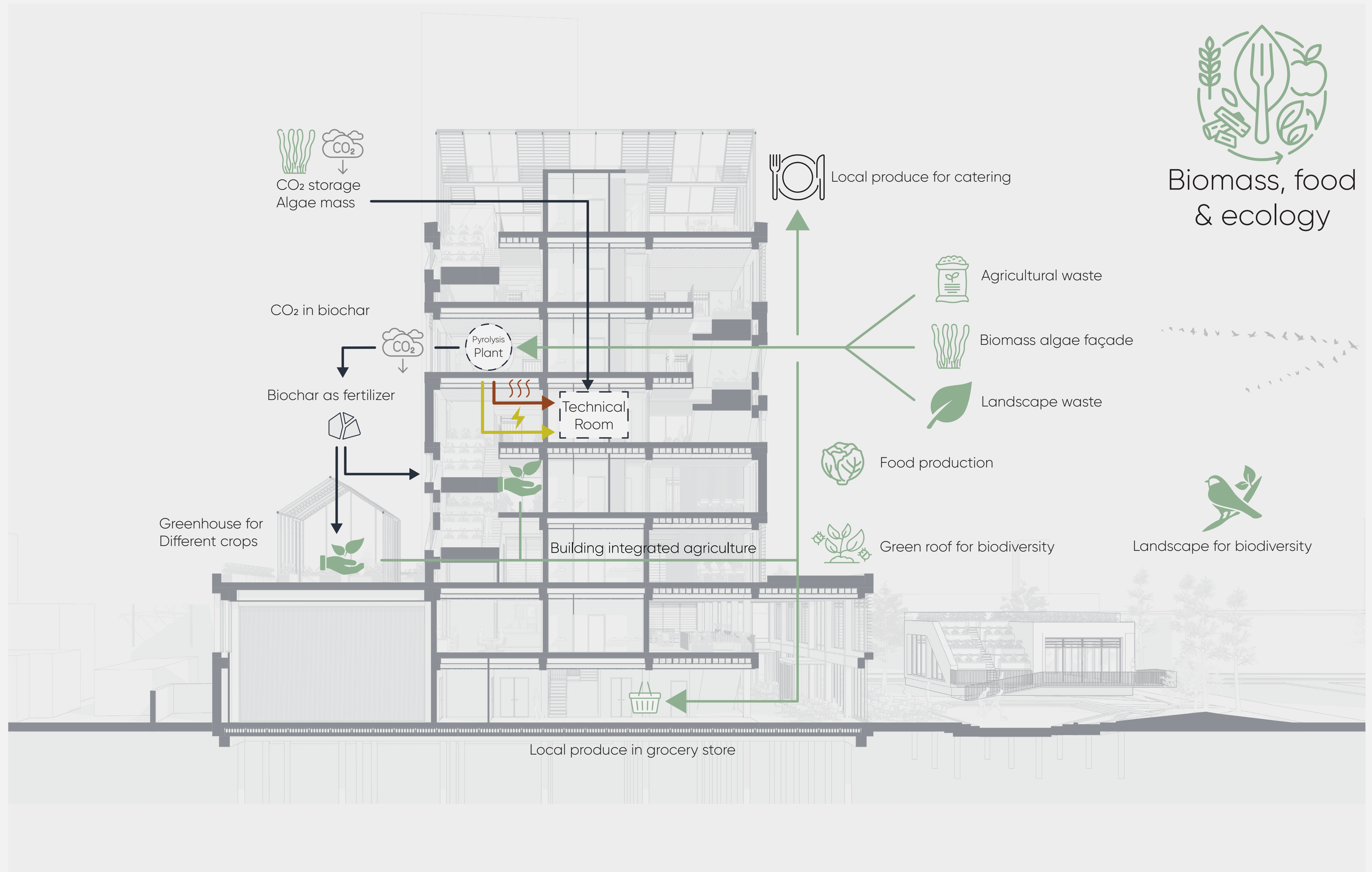


FIRST FLOOR

- Start of urban agriculture
- Repair café
- Meeting spaces
- Workplaces







SECOND FLOOR

- Educational facilities
- Outside section urban agriculture
- Roofscape

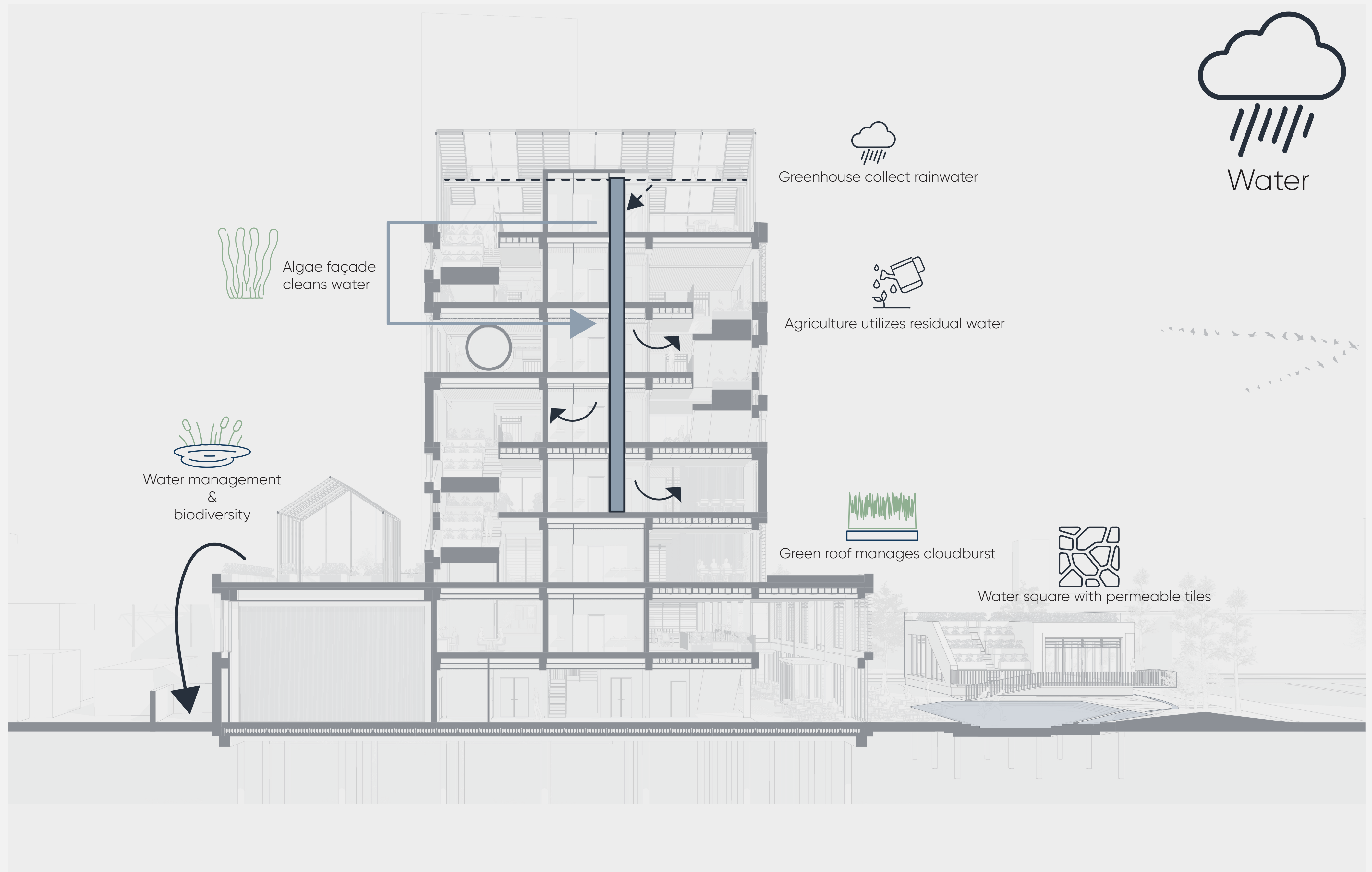




DANISH FOOTPRINT

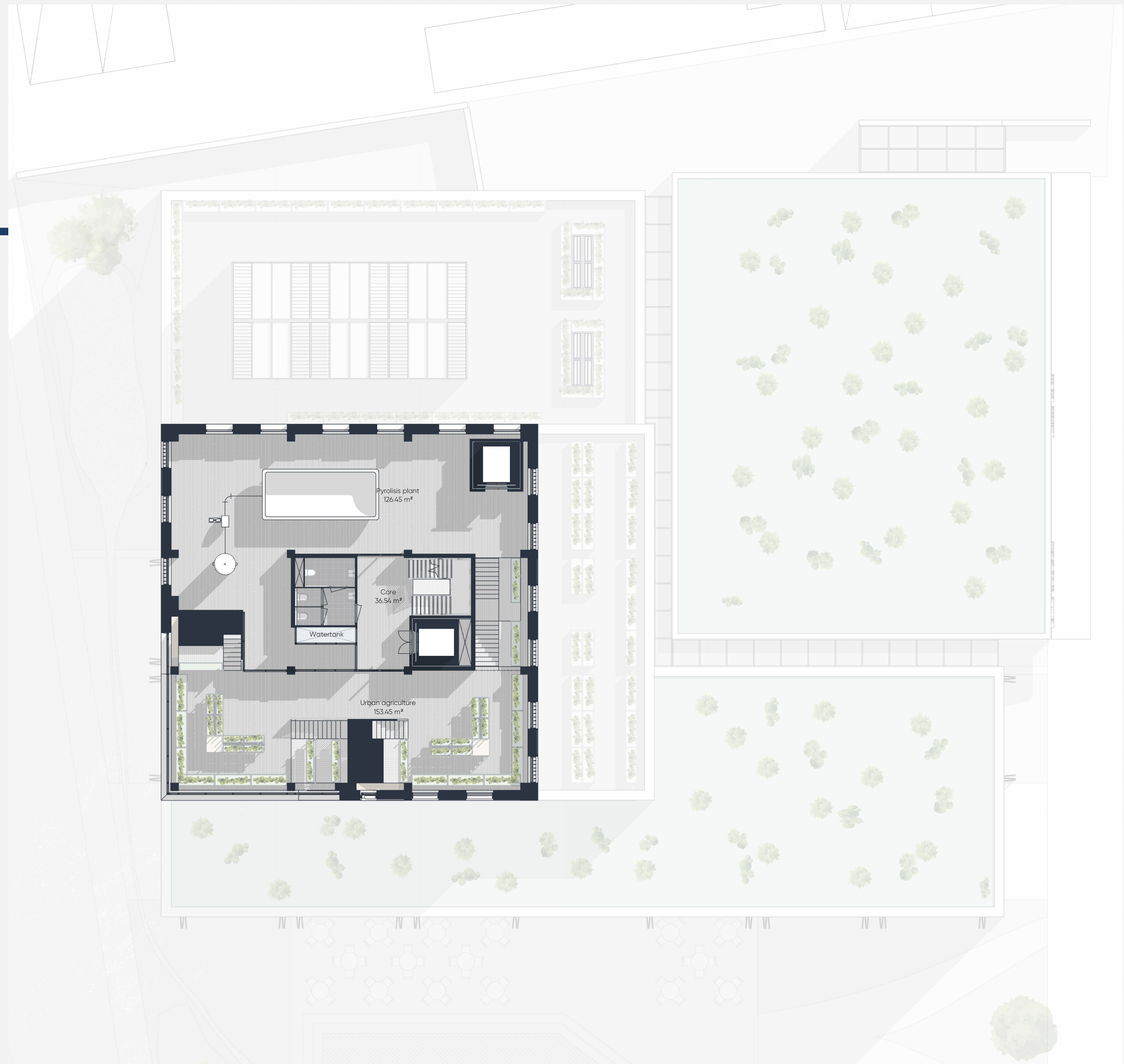
- Often perceived as sustainable country
- 4 times the allowed maximum emissions
- Large portion to transport, food & housing





FIFTH FLOOR

- Urban agriculture in the tower
- Local produce and part of the journey
- Pyrolysis plant

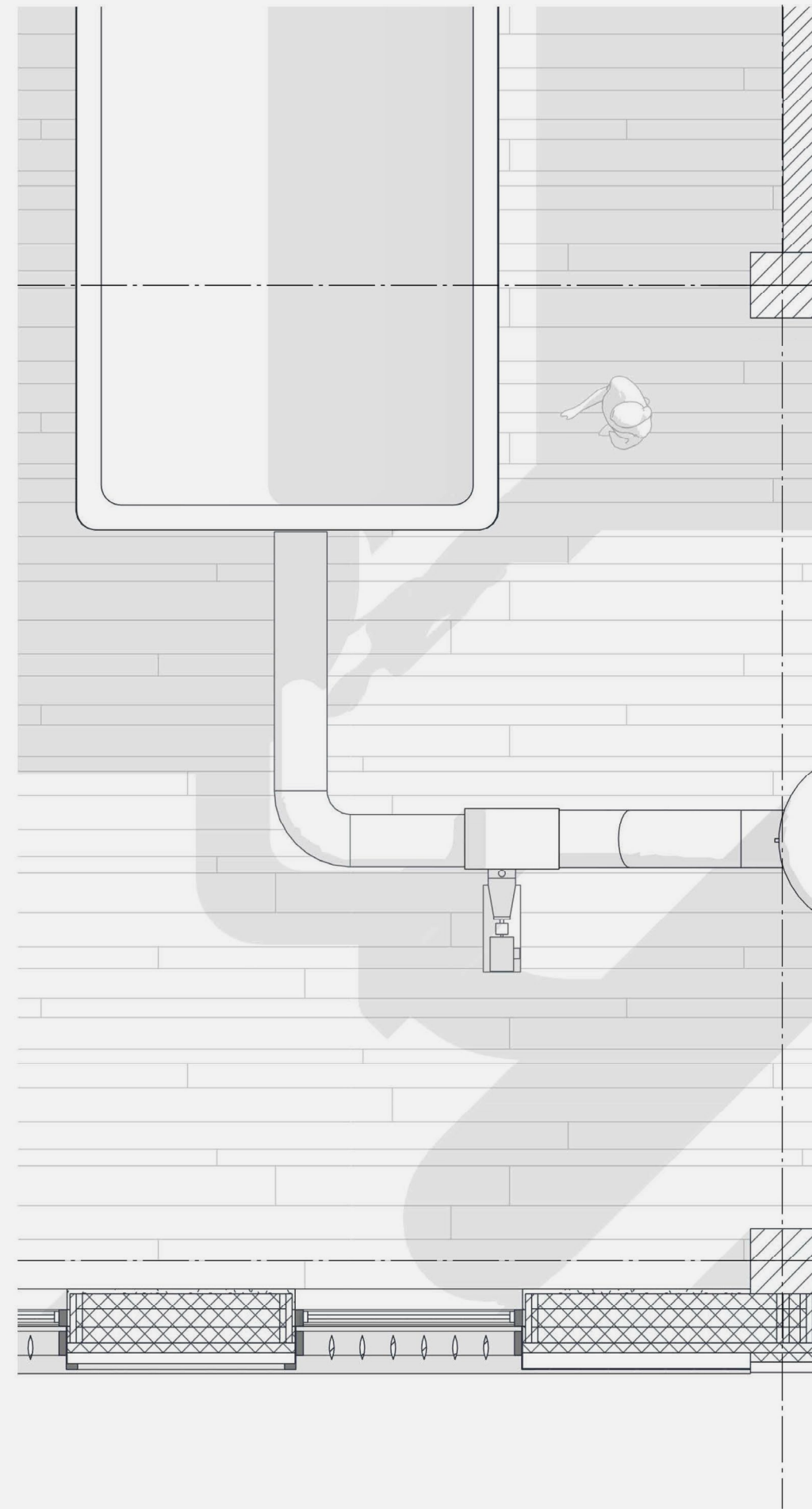




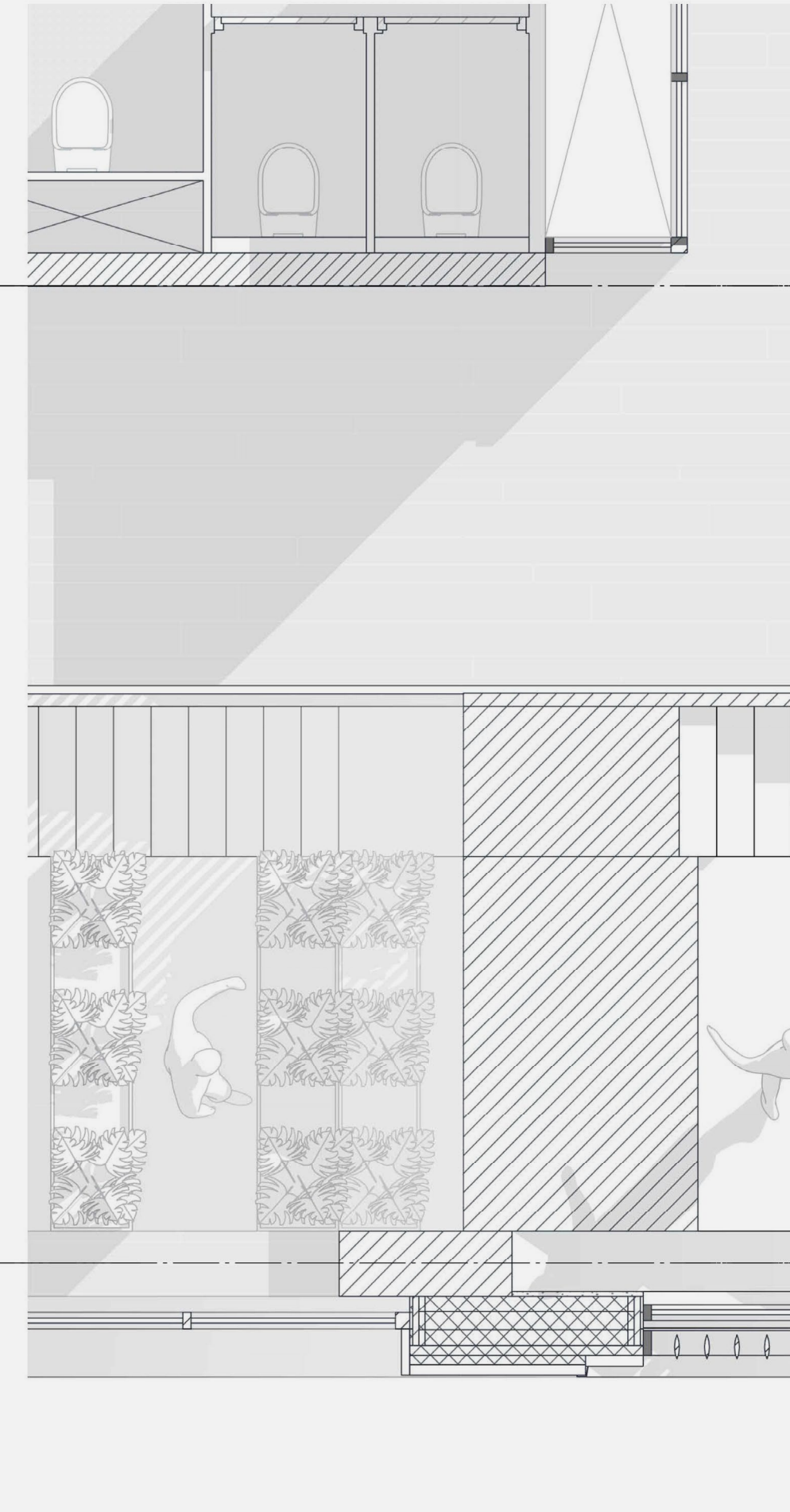
FRAGMENT



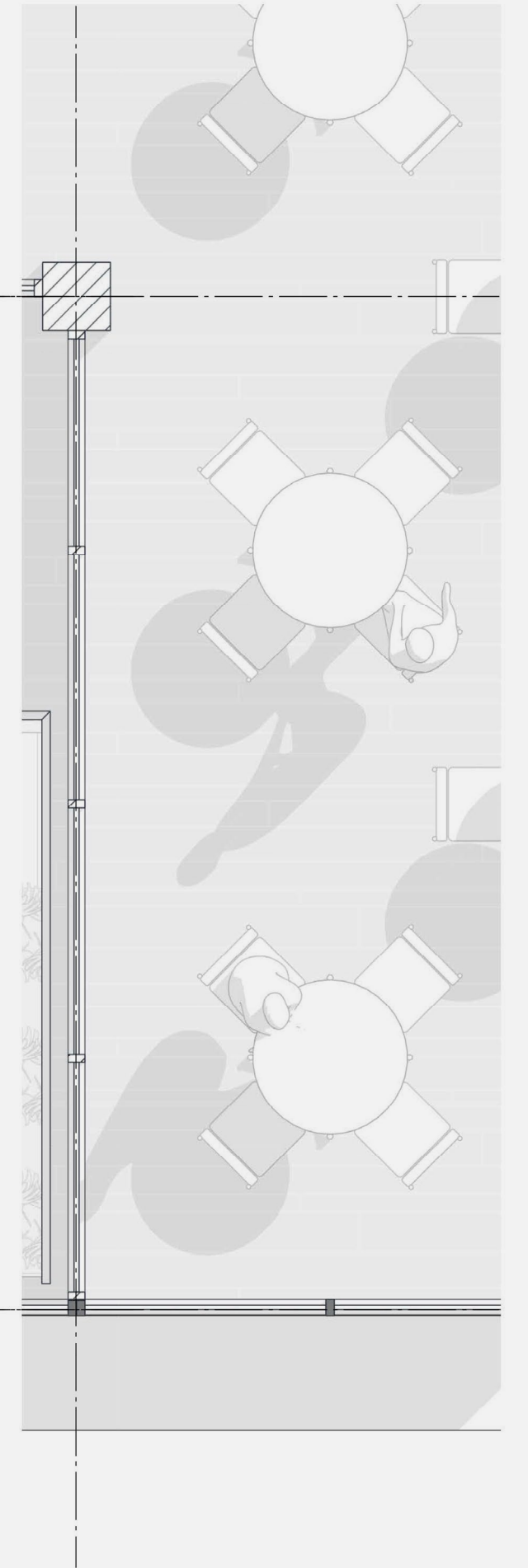
AXO view



5th floor | Pyrolysis plant



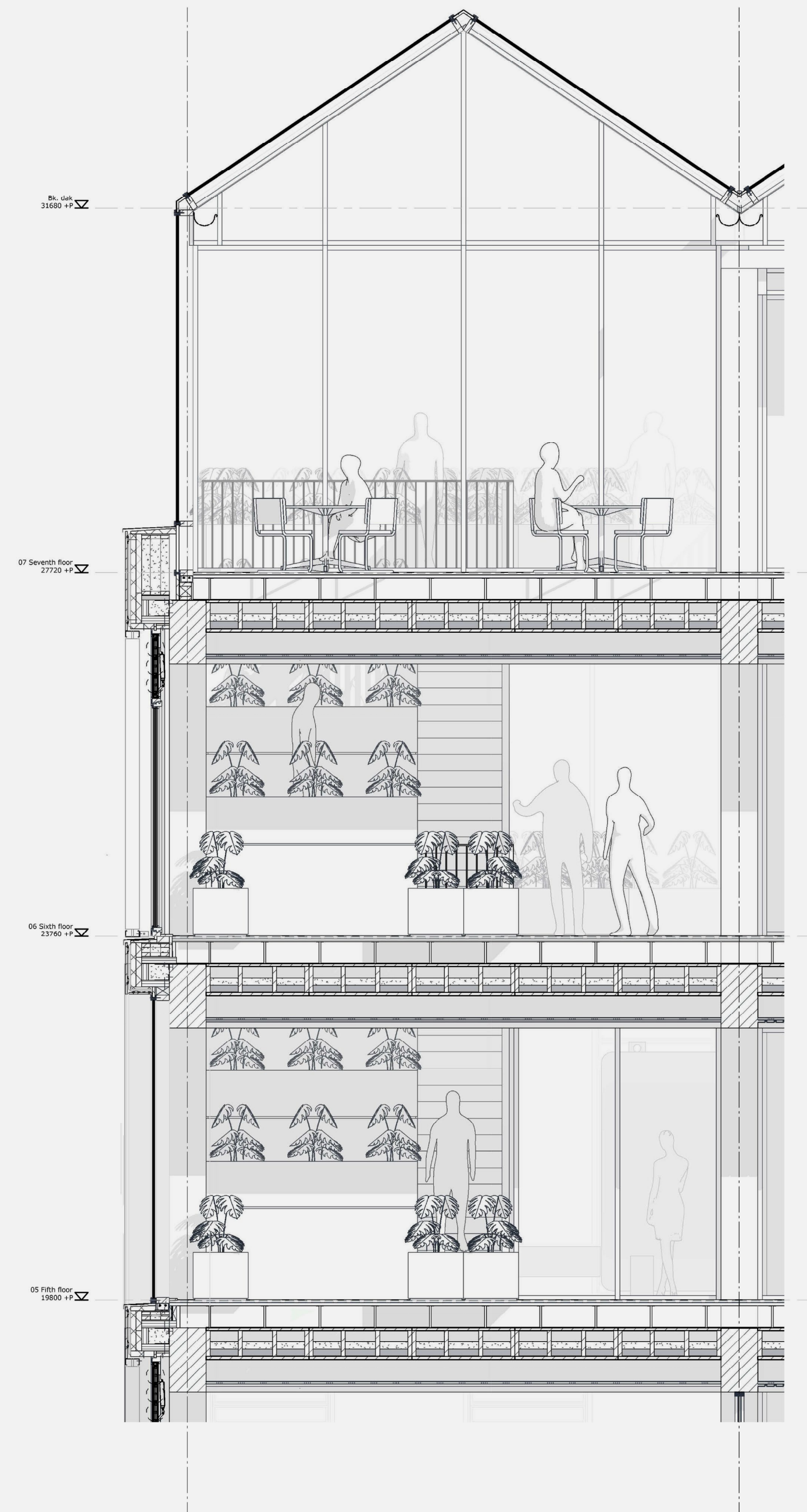
6th floor | Urban agriculture



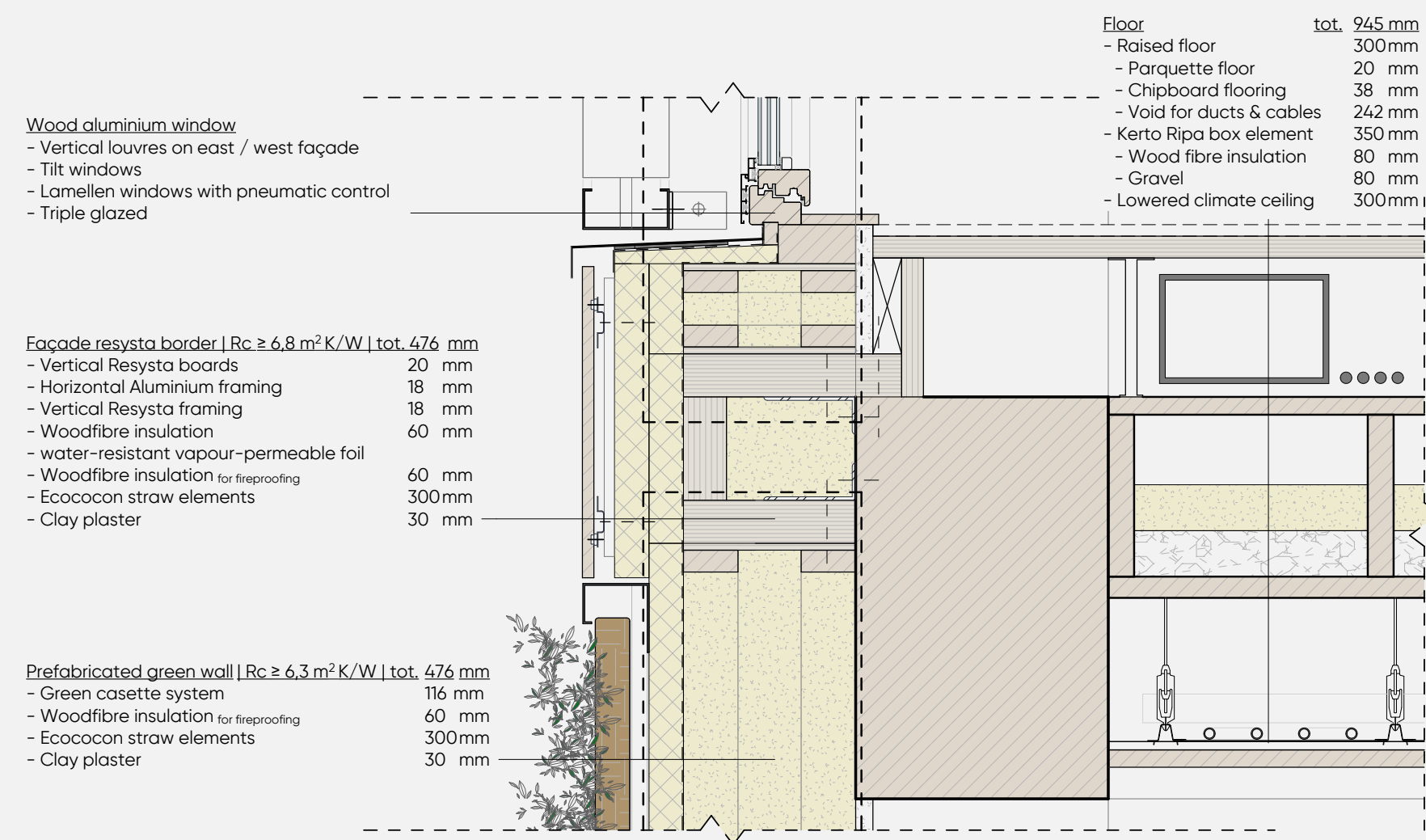
7th floor | Dining

FRAGMENT

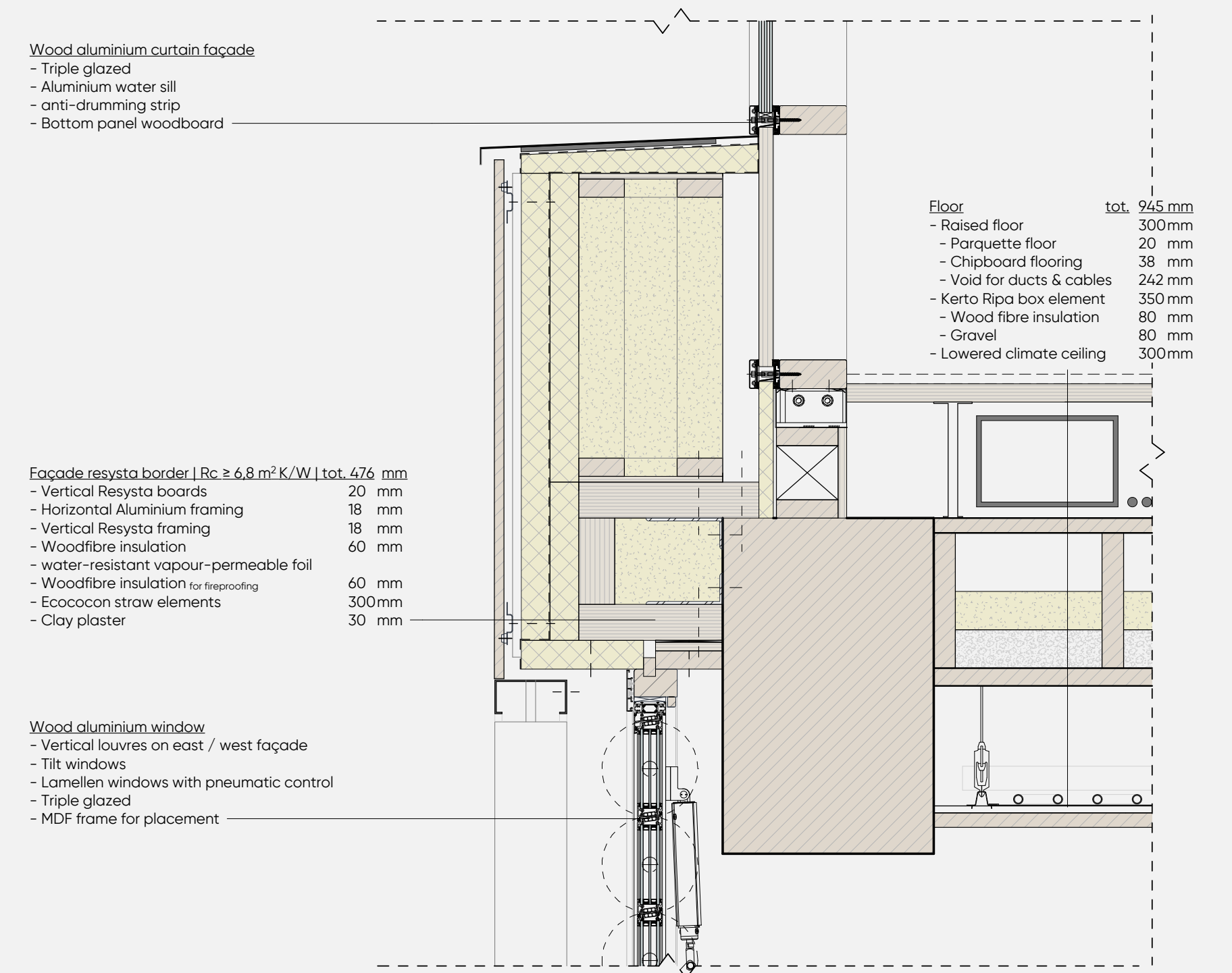
- Identity of the urban agriculture
- Checkered façade with infills
- Continuous curtain façade



DETAILS



Detail with standard element and aluminum wood window



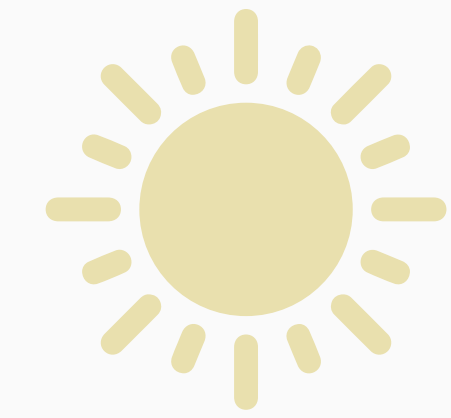
Detail Louvre window and start greenhouse

ROOFTOP TERRACE

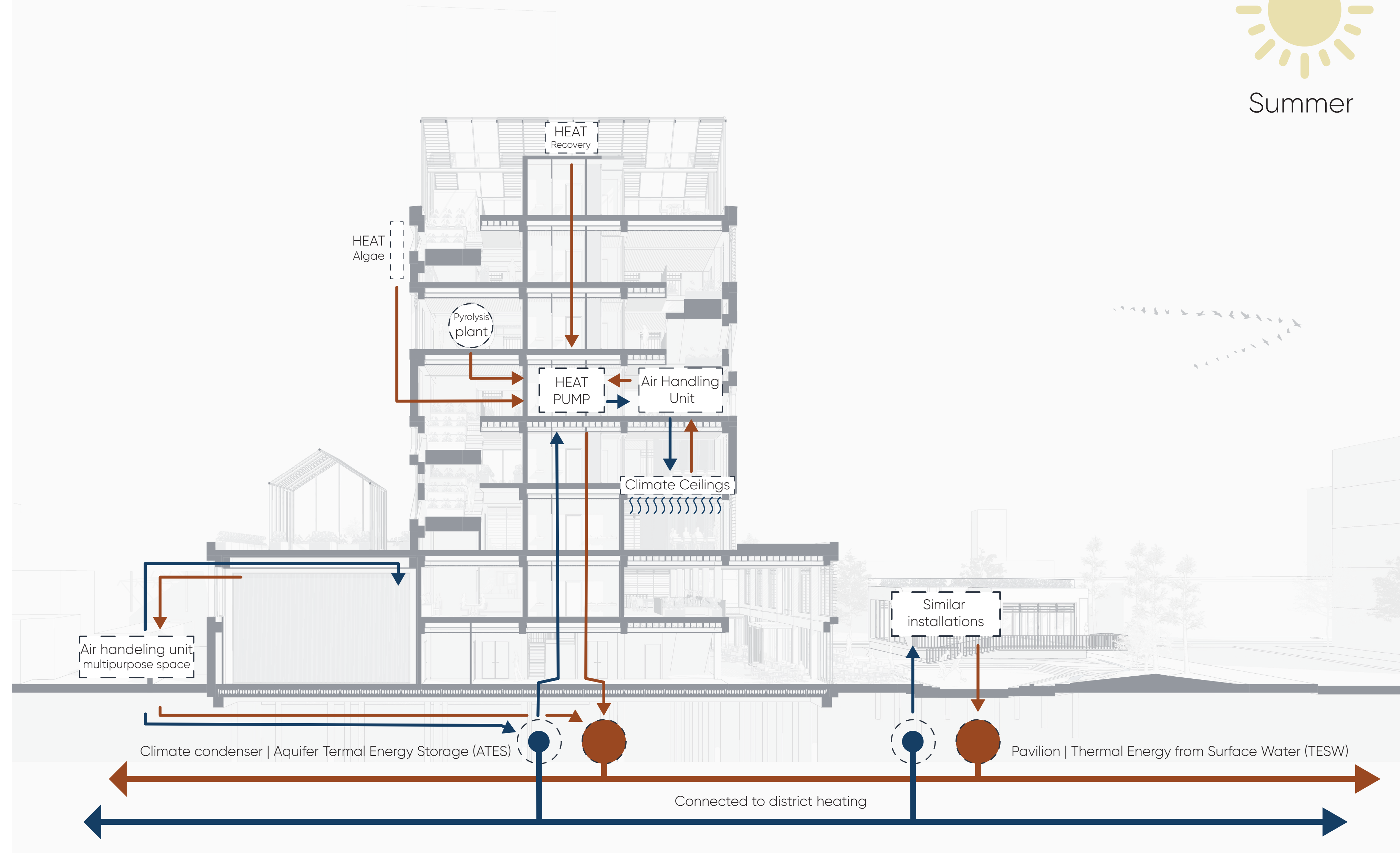
- Attractor of rooftop bar
- End of urban agriculture

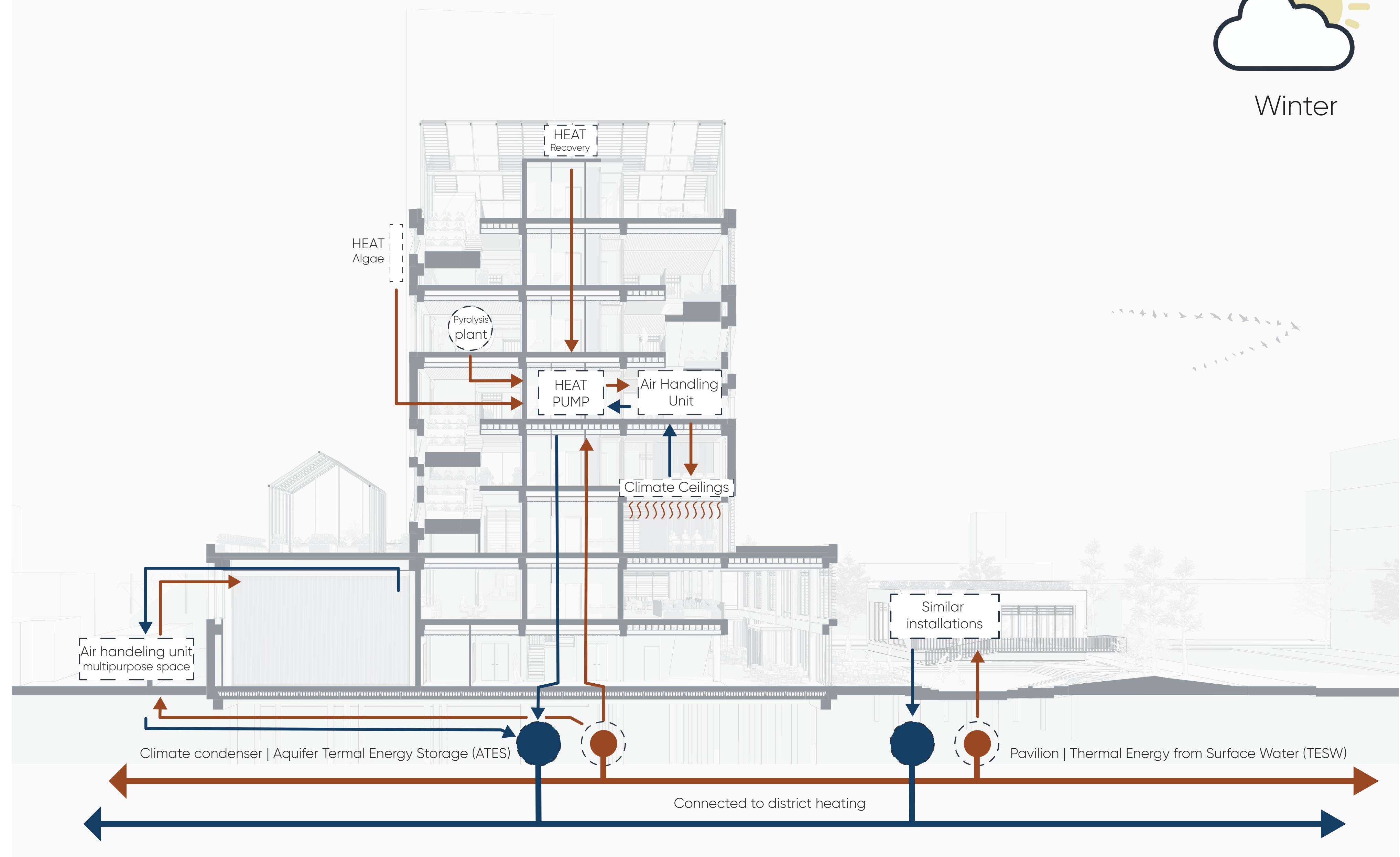






Summer

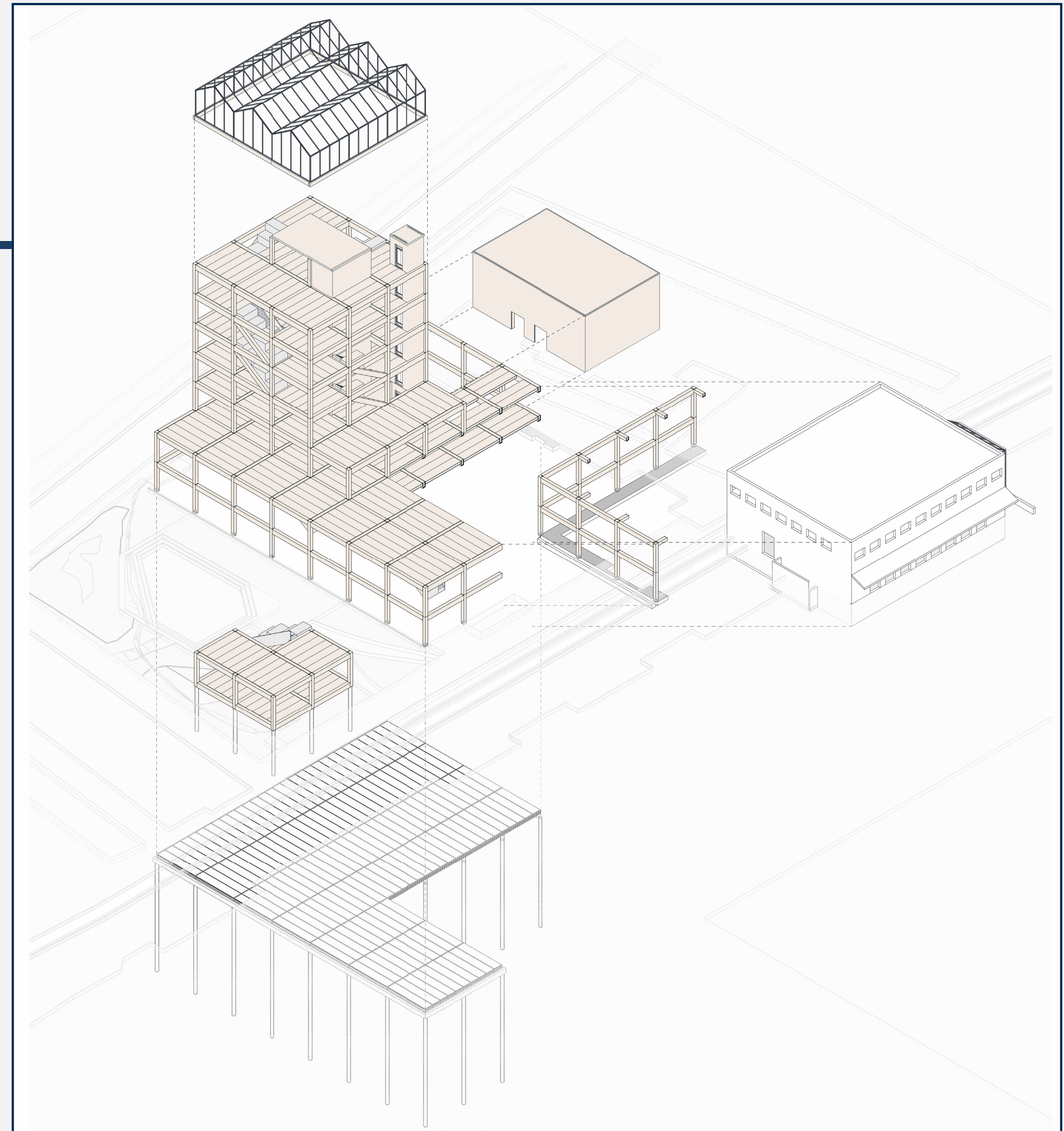




STRUCTURE

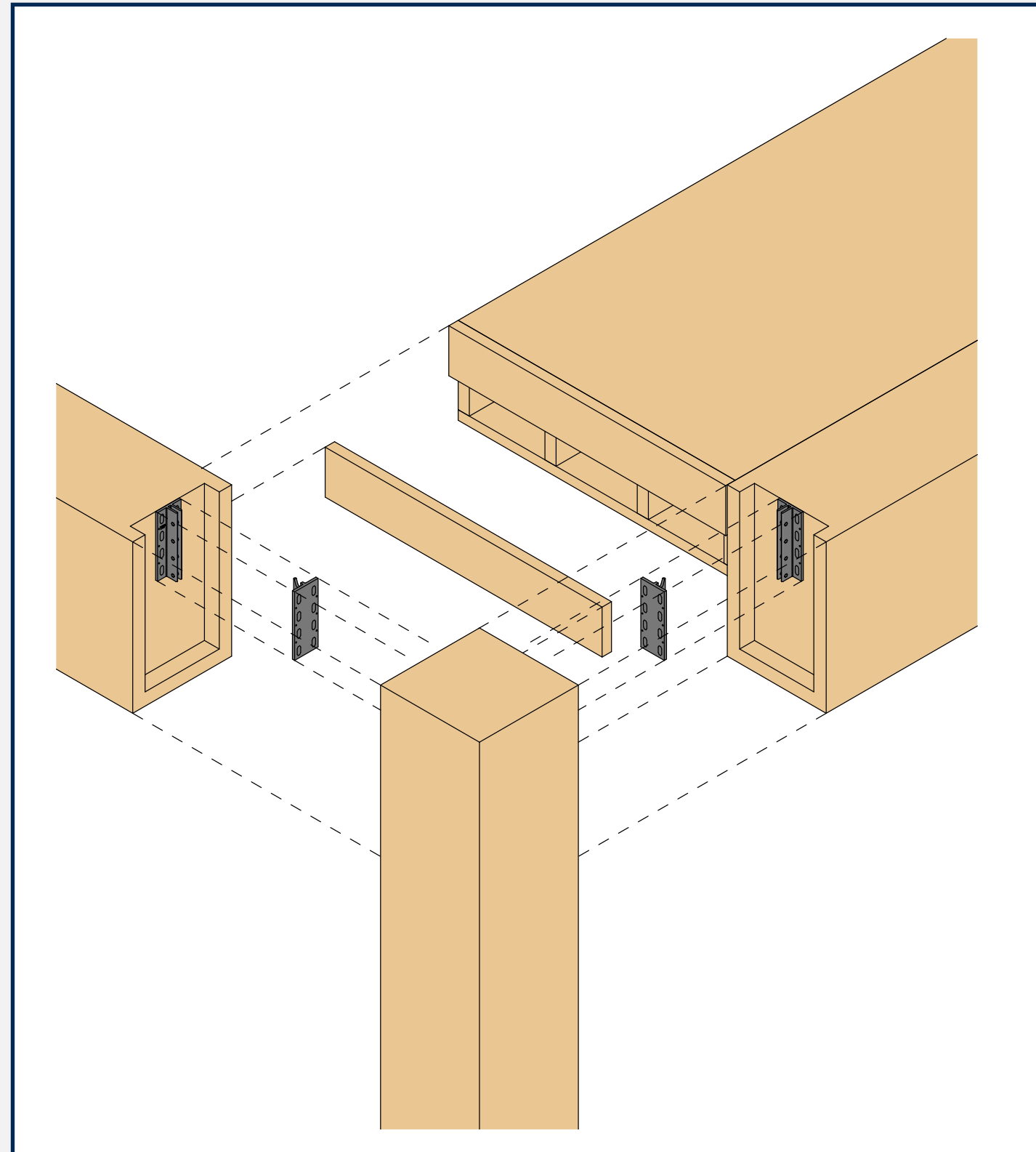
Typical 6 x 6 meters grid

- Remountable concrete hollow core slab
- Glulam system
 - 440 x 440mm Columns
 - 440 x 700mm Beams
- Kerto Ripa Box | hollow timber slabs
- Pavilion on ground screw poles
- Multipurpose hall with CLT and Glulam



STRUCTURE | CLOSE UP

- Rothoblaas Alumega connections
- Kerto ripa box notched imposition
- Remountable



Kerto ripa box

Laminated beam for kerto ripa box

Glulam 440 x 700mm

Glulam 440 x 440mm

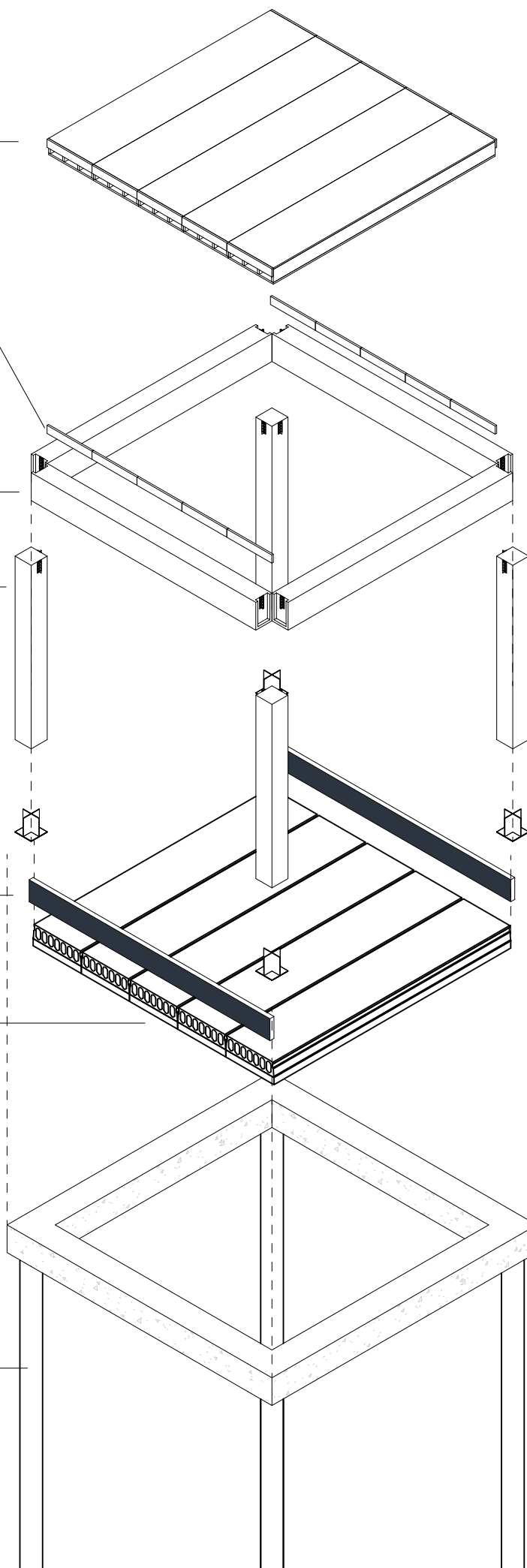
Steel insert plate

Plywood to keep separation possible

Remountable hollow slab floors

Concrete foundation

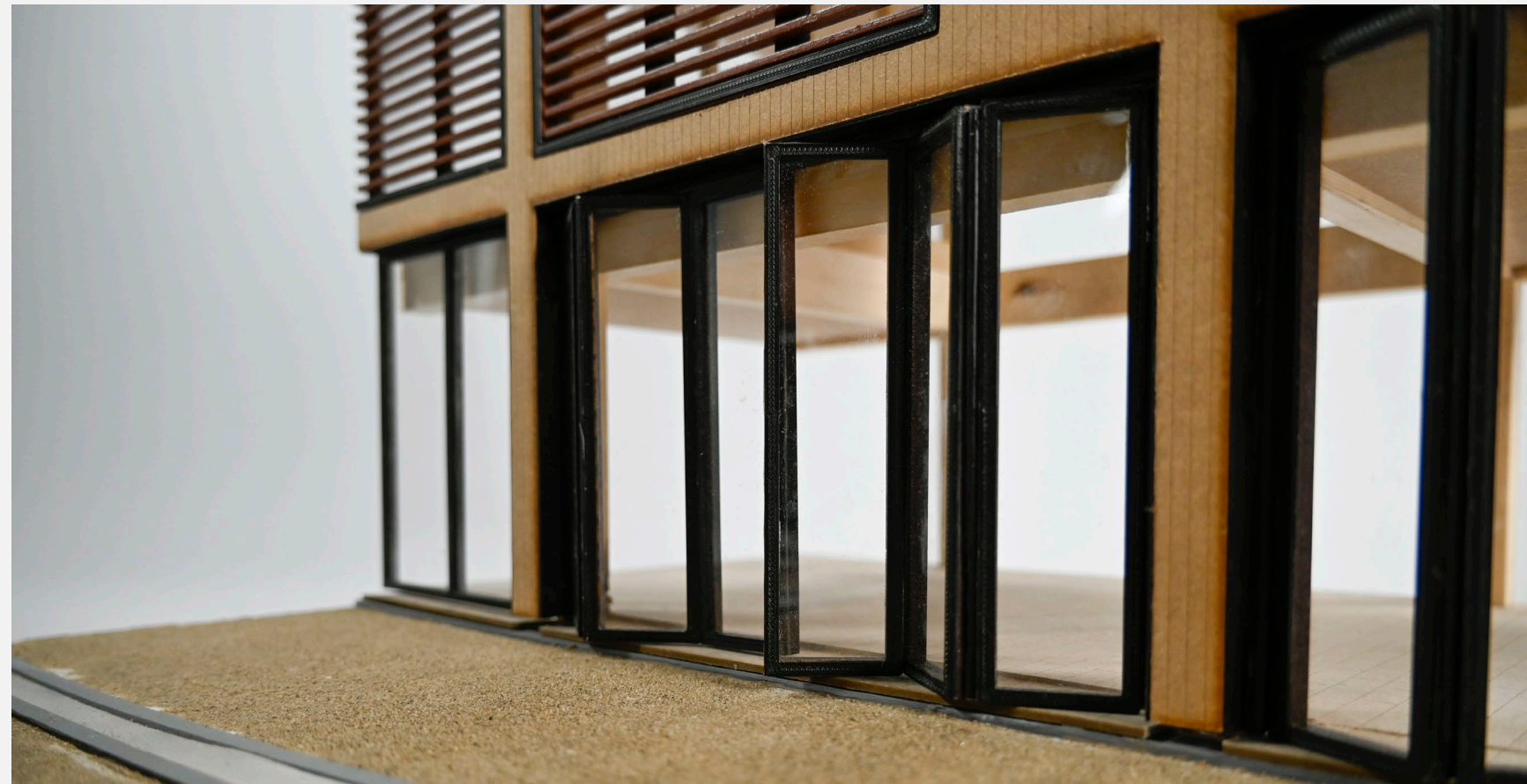
Permanent concrete screw poles



BUILD UP MODEL



INTERIOR MODEL



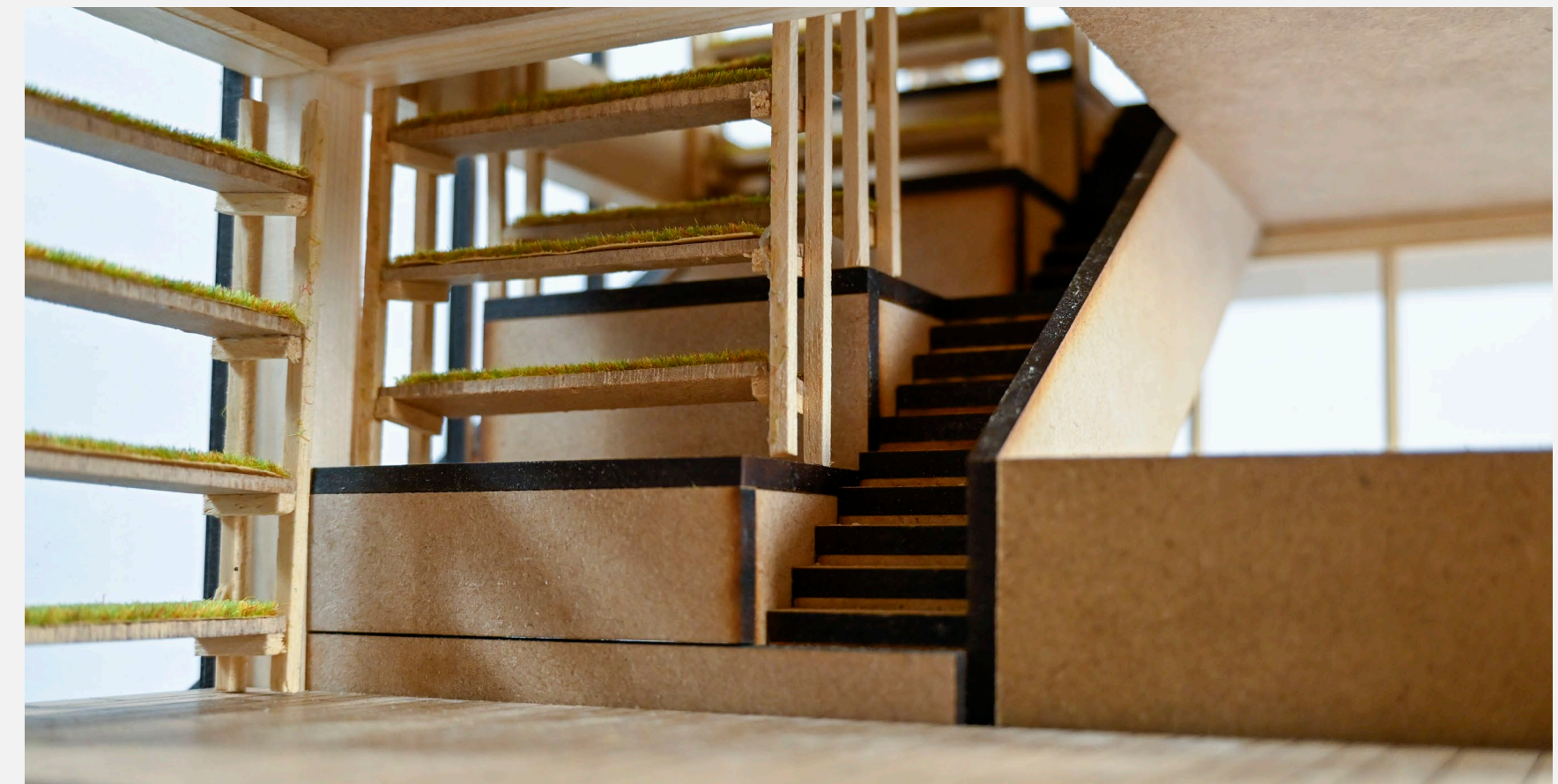
Entrance foyer



Foyer

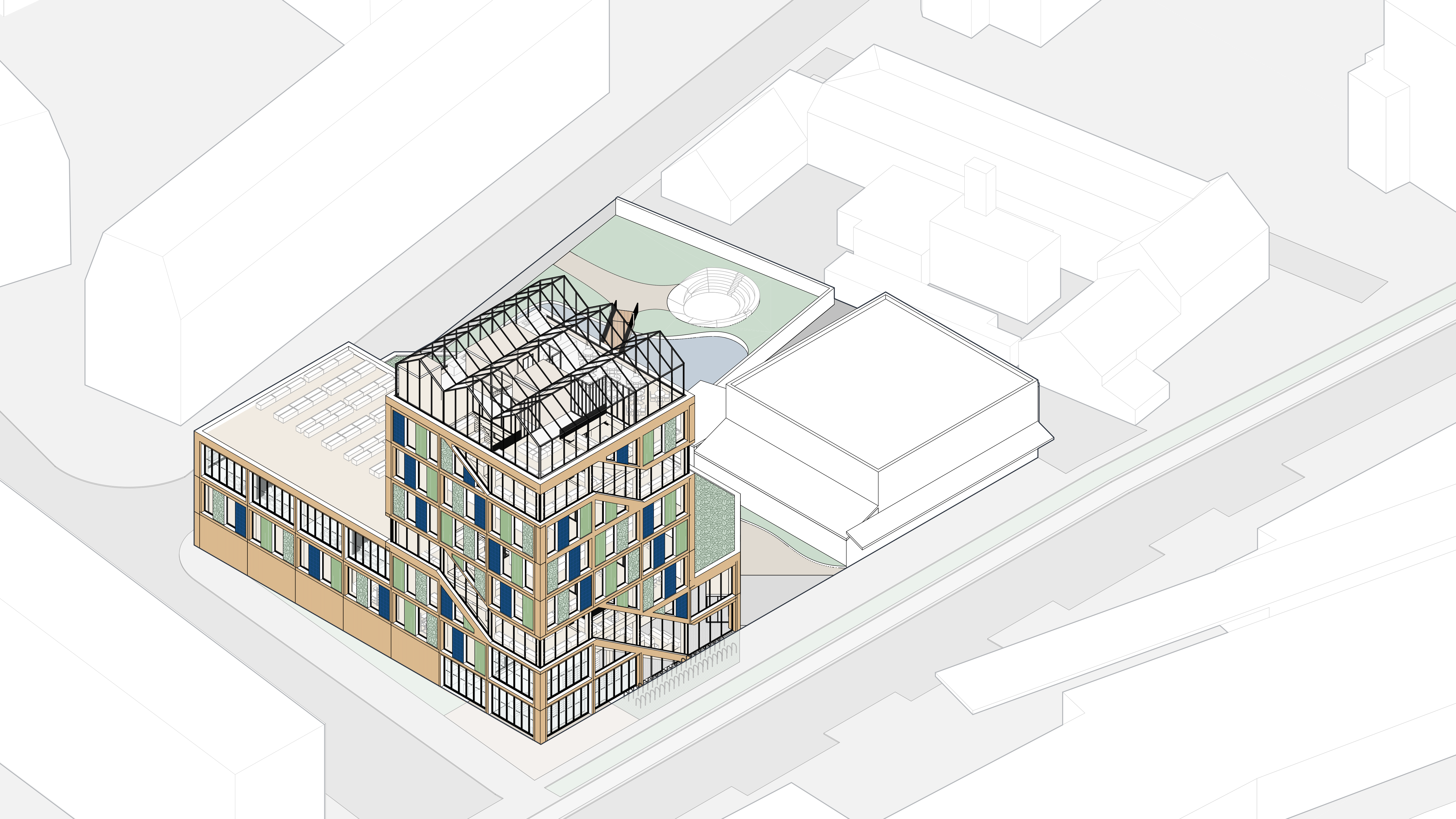


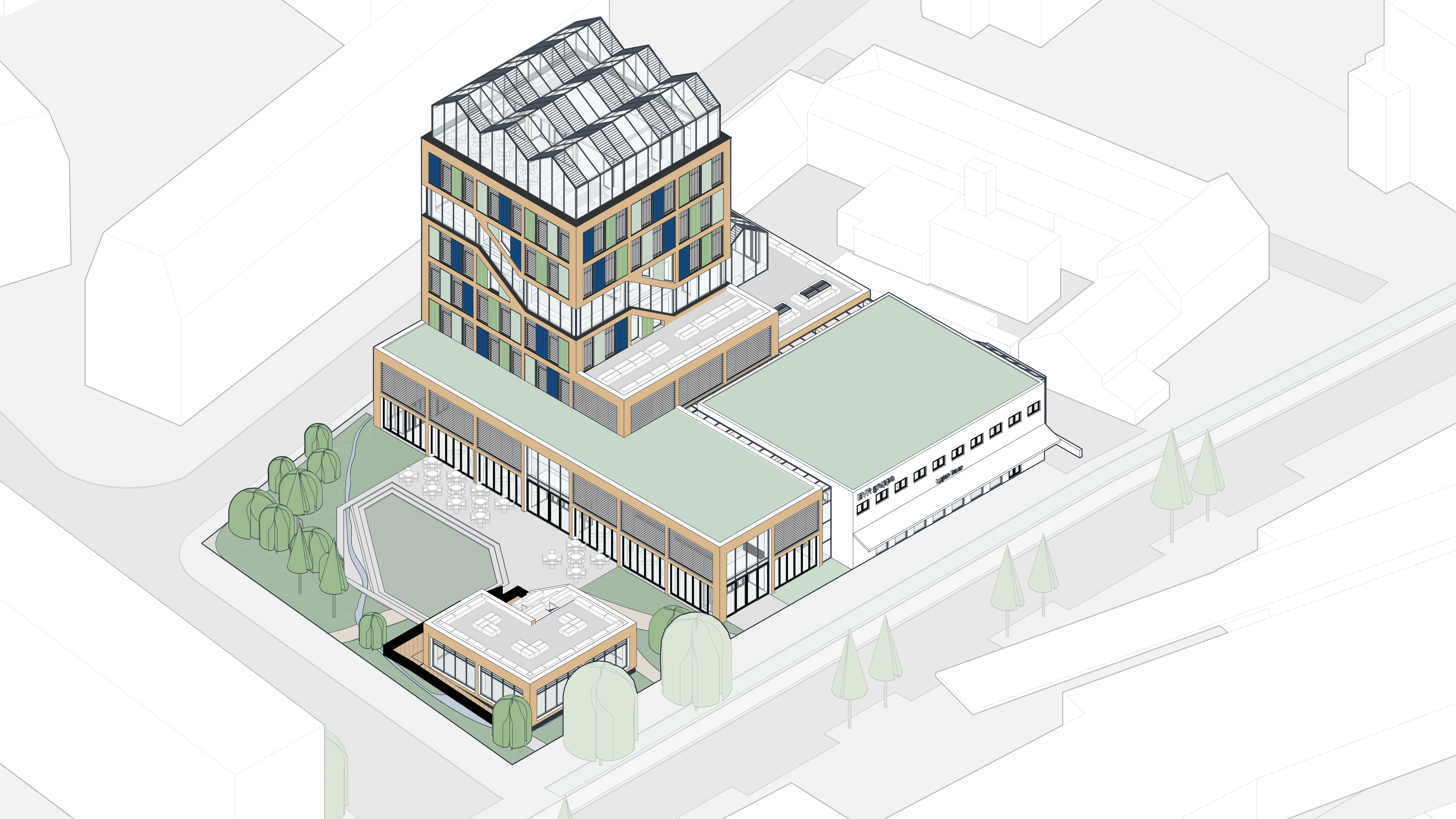
View on Building Integrated Agriculture

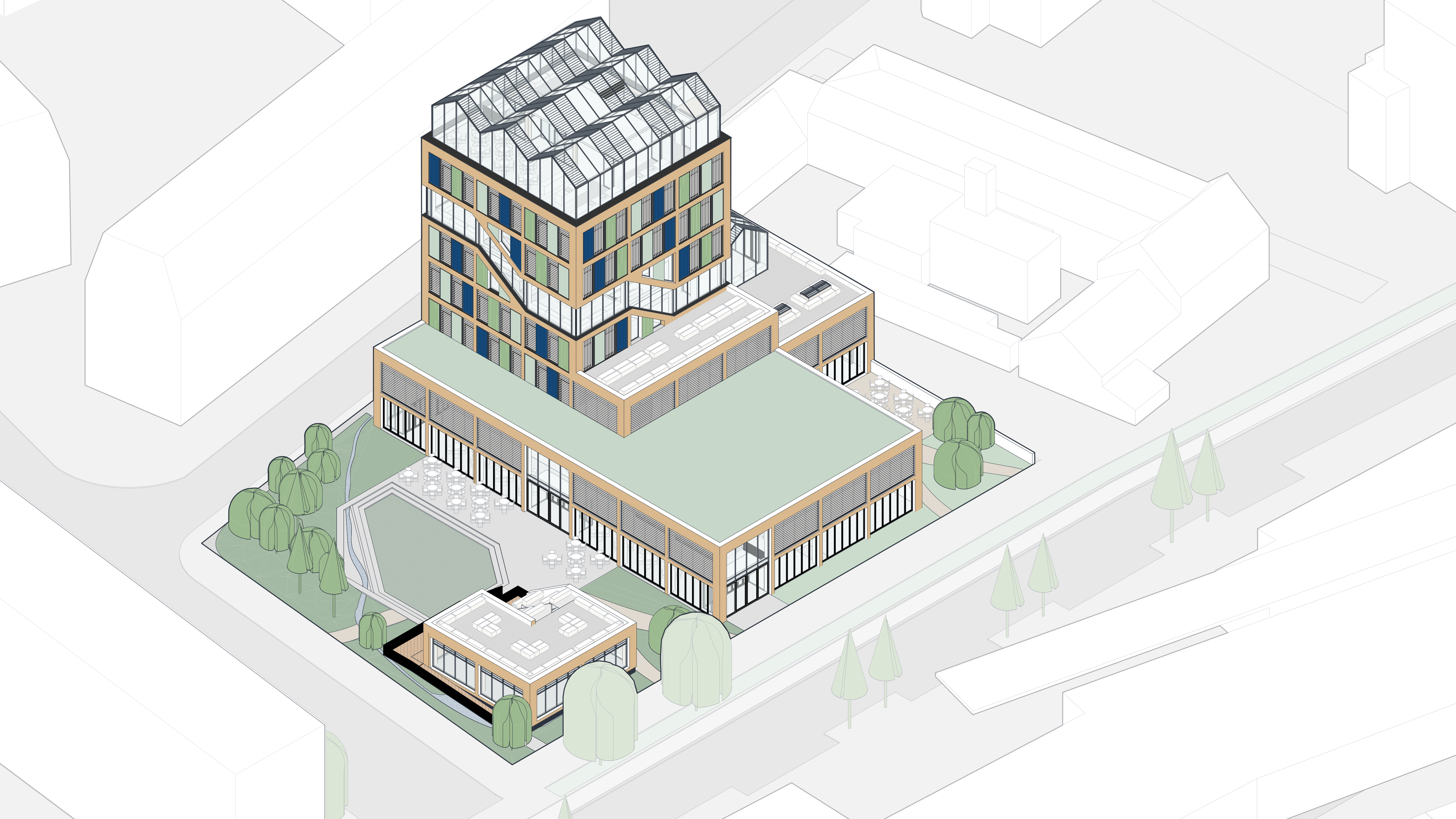


View on Building Integrated Agriculture

SCENARIOS.









Thank you for your attention