



# ARCHITECTURE STUDENT CONTEST

19<sup>th</sup> INTERNATIONAL EDITION, HELSINKI 2024

| 17116 |

UK

University of Nottingham

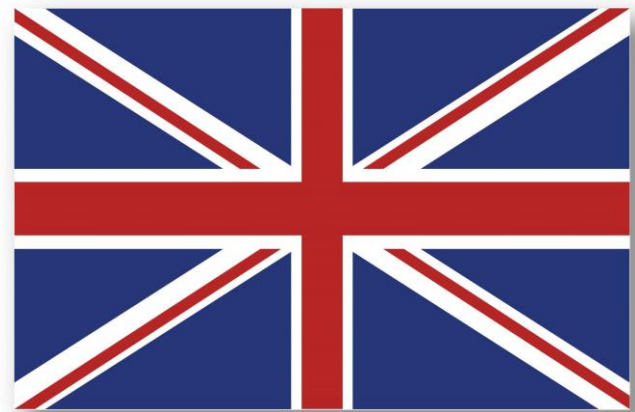
**Rahul Khimji & Isabel McDonald**

# THE TEAM

University of Nottingham

Presentation no. 7

Lecturer:  
Guillermo Guzman



**ISABEL MCDONALD**



**RAHUL KHIMJI**

# OUR STATEMENT

In fifty years when Finland is net zero carbon, we want our site to reflect this in the changes of structure and outdoor environment.

Our project preserves an open space for people to experience a harmonious work life balance without the constraints a typical built environment would provide.

Instead creates an interdisciplinary space incorporating nature into everyday life to pursue a healthier and happier circular economy-like community.

The built environment within the site is designed as a tectonic system, in which the form can find itself and change throughout its uses.

By using sustainable materials and renewable energy we are working towards the net zero carbon goal, as well as an interactive and adaptable creative learning space.

**We are environmentally responsive.**

**We are socially regenerative.**

**We are a systemic approach ready to evolve with you.**

## ORIENTATION

The buildings to be demolished are facing each other, with entrances to the N and S. The building to be refurbished is curved inwards towards the W,

## SITE DESCRIPTION

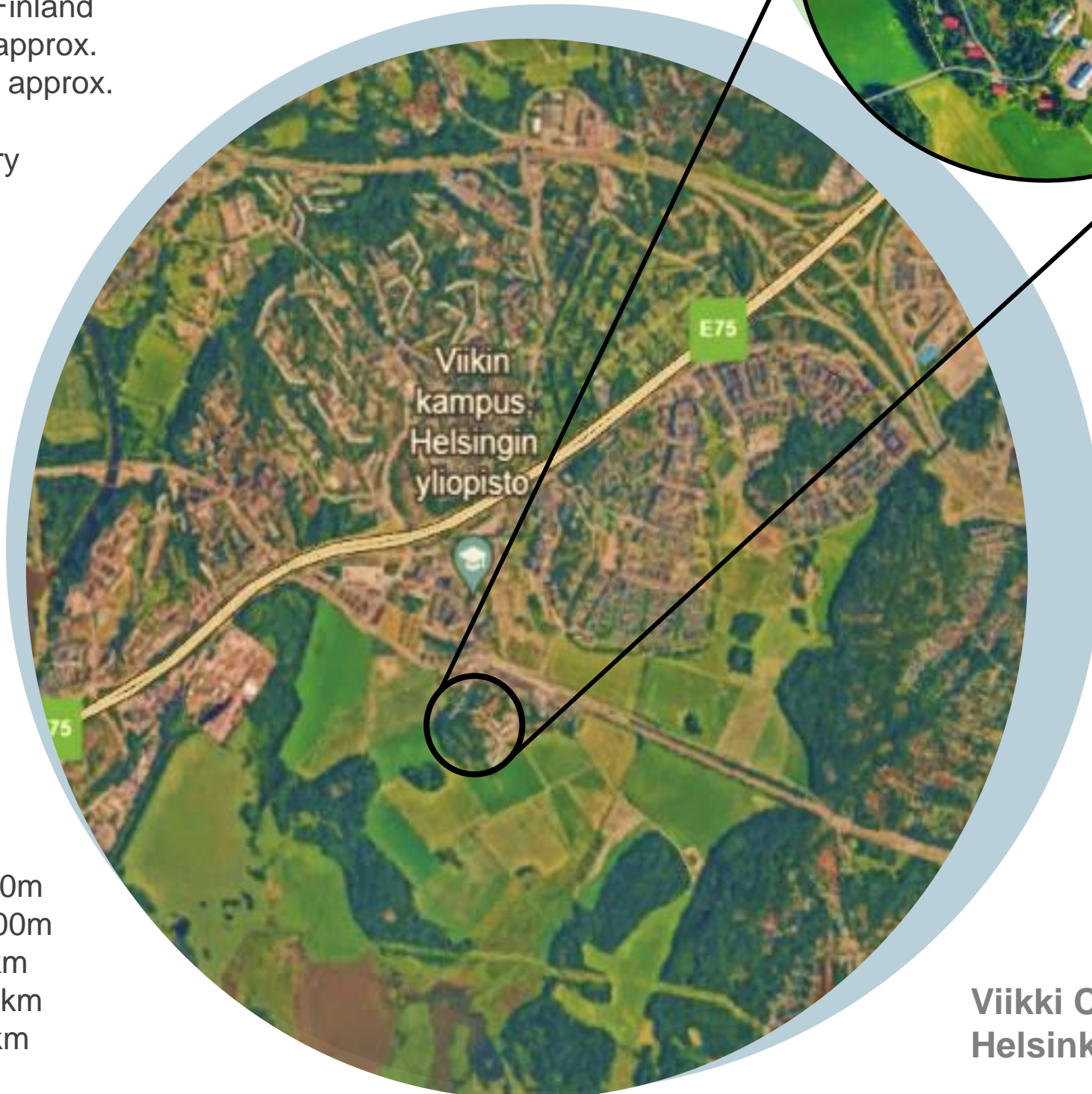
Site location- Helsinki, Finland  
 Area of site- 36,000m<sup>2</sup> approx.  
 Perimeter of site- 800m approx.  
 Hottest month- July  
 Coldest month- February  
 Climate- Humid, continental

## WIND ANALYSIS

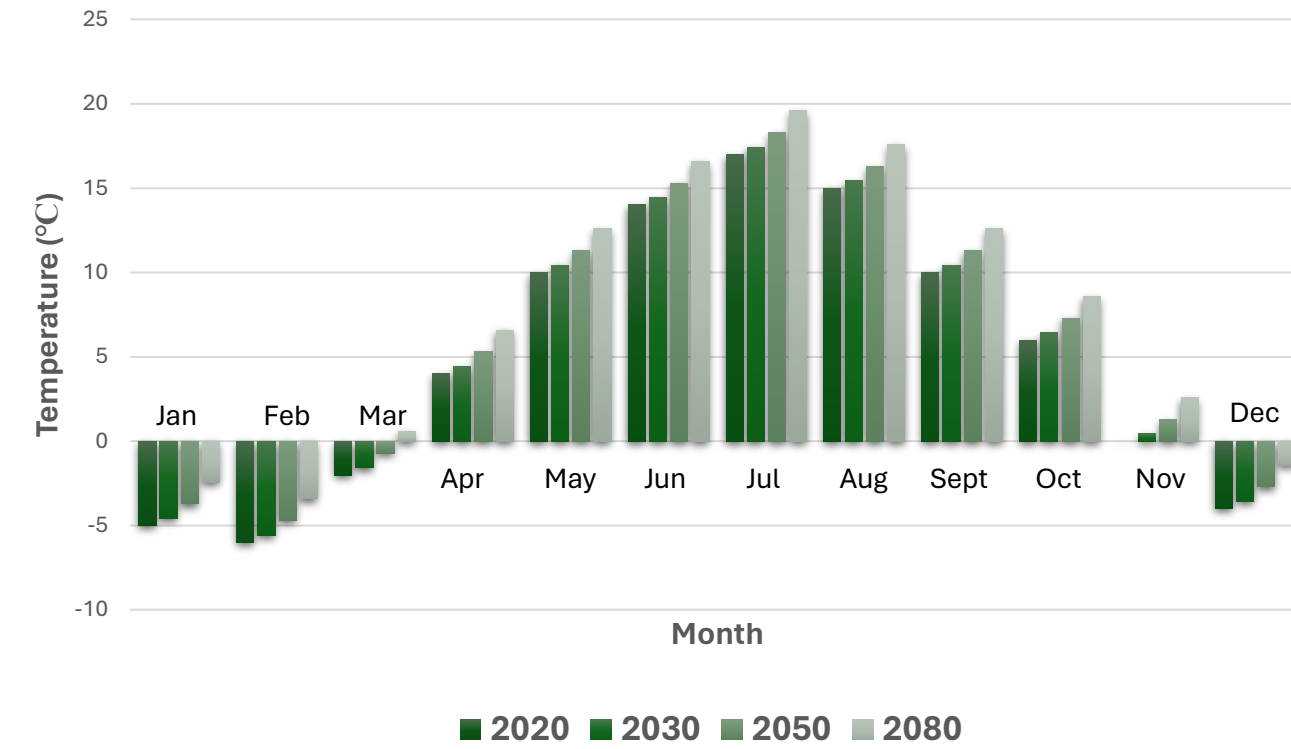
Wind direction from the East has an average speed between 2,5 and 4 m/s inland, typically highest in winter and lowest in summer.

## ACCESSIBILITY FROM THE SITE

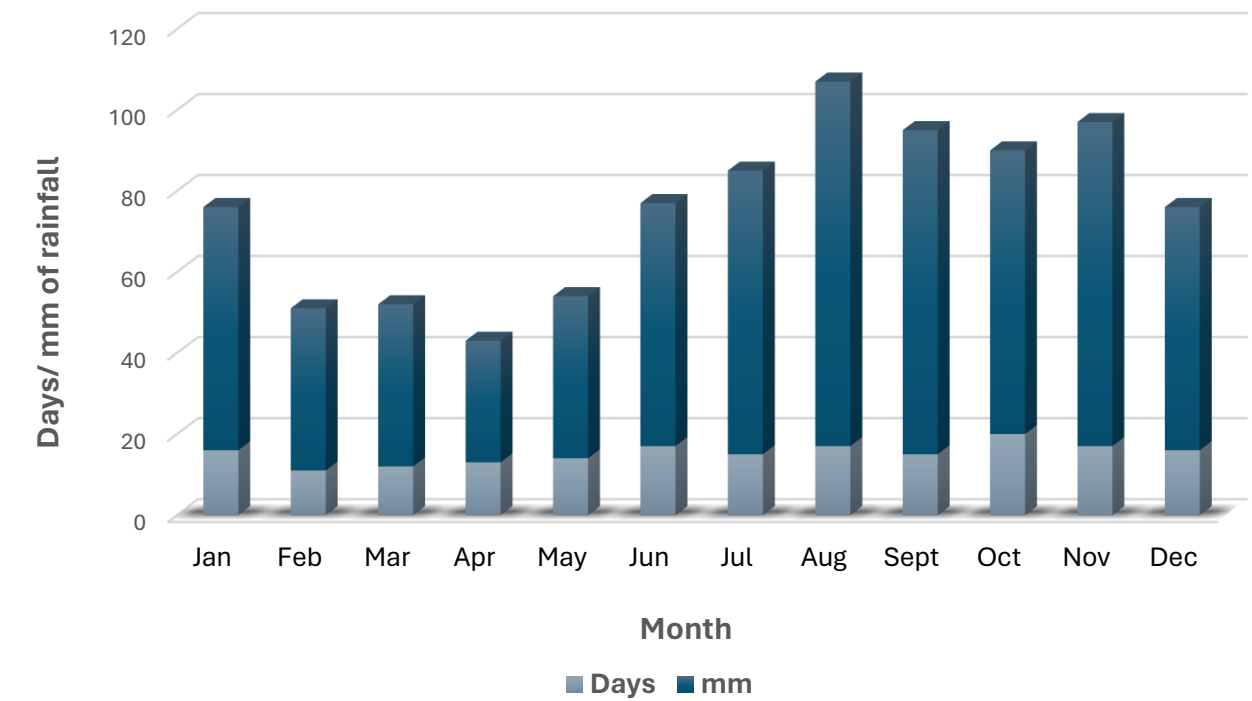
- Restaurants - 0m
- Bus stop - 280m
- Tram stop - 300m
- Supermarket - 1.1km
- Pharmacy - 1.4km
- Airport - 5km



## Average Temperature of Helsinki



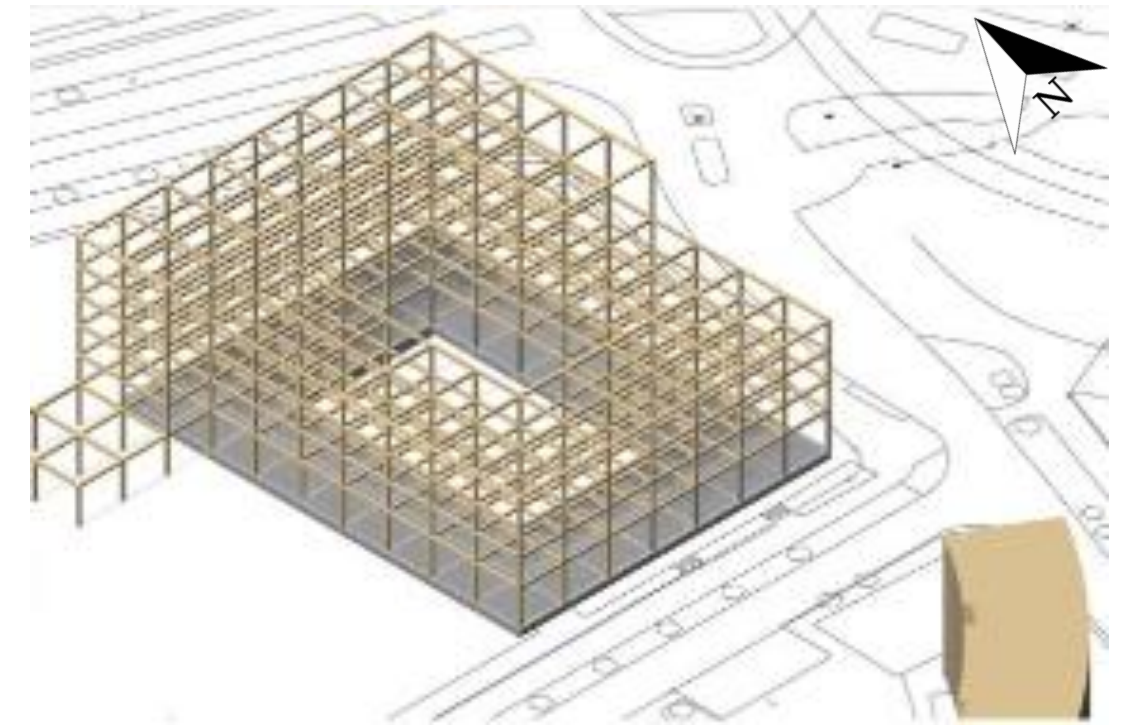
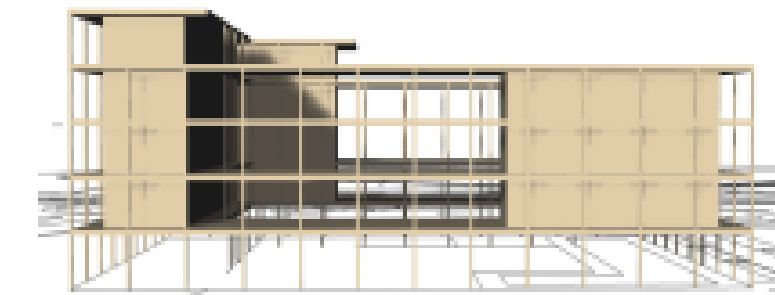
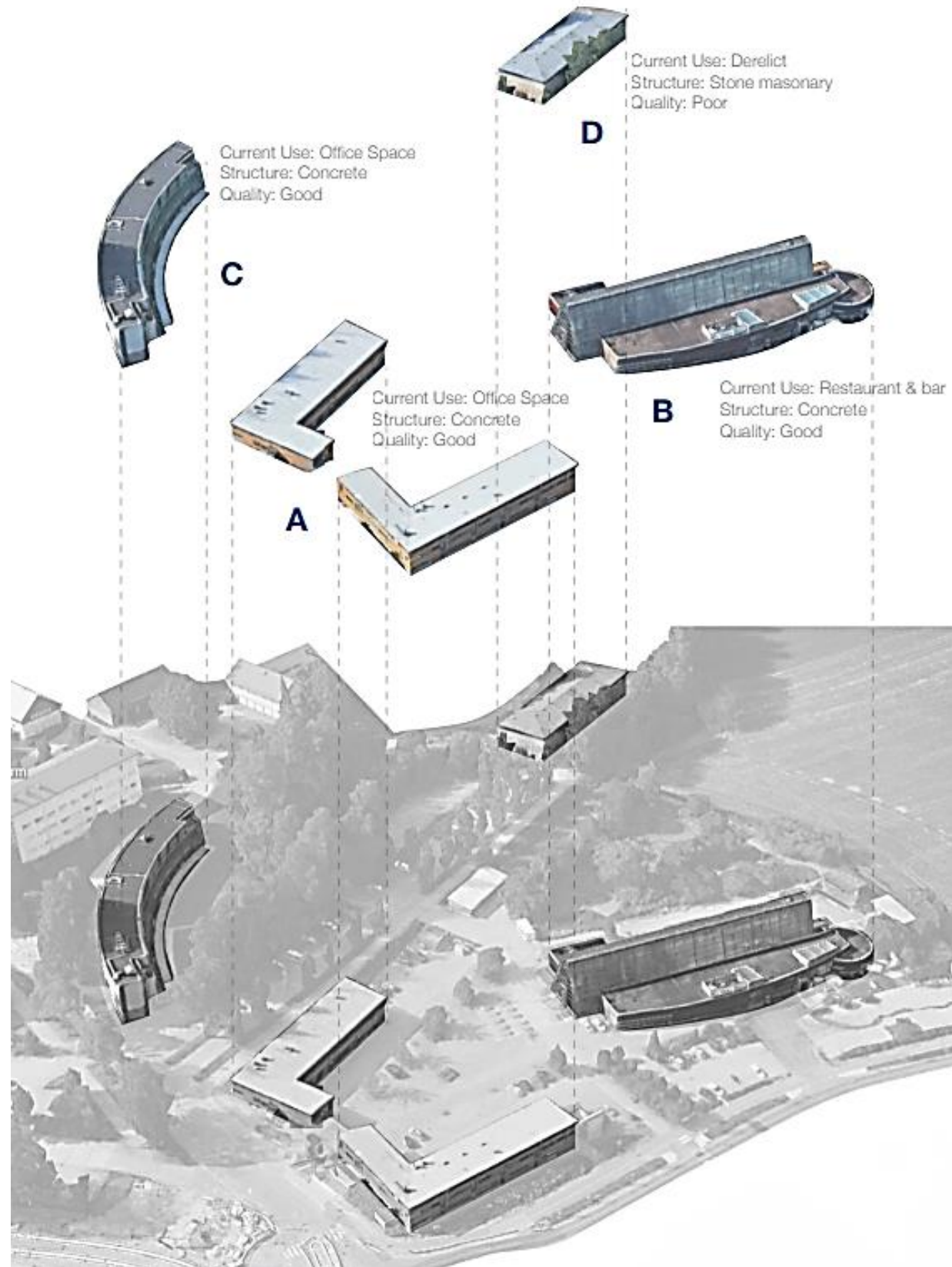
## Average Rainfall of Helsinki



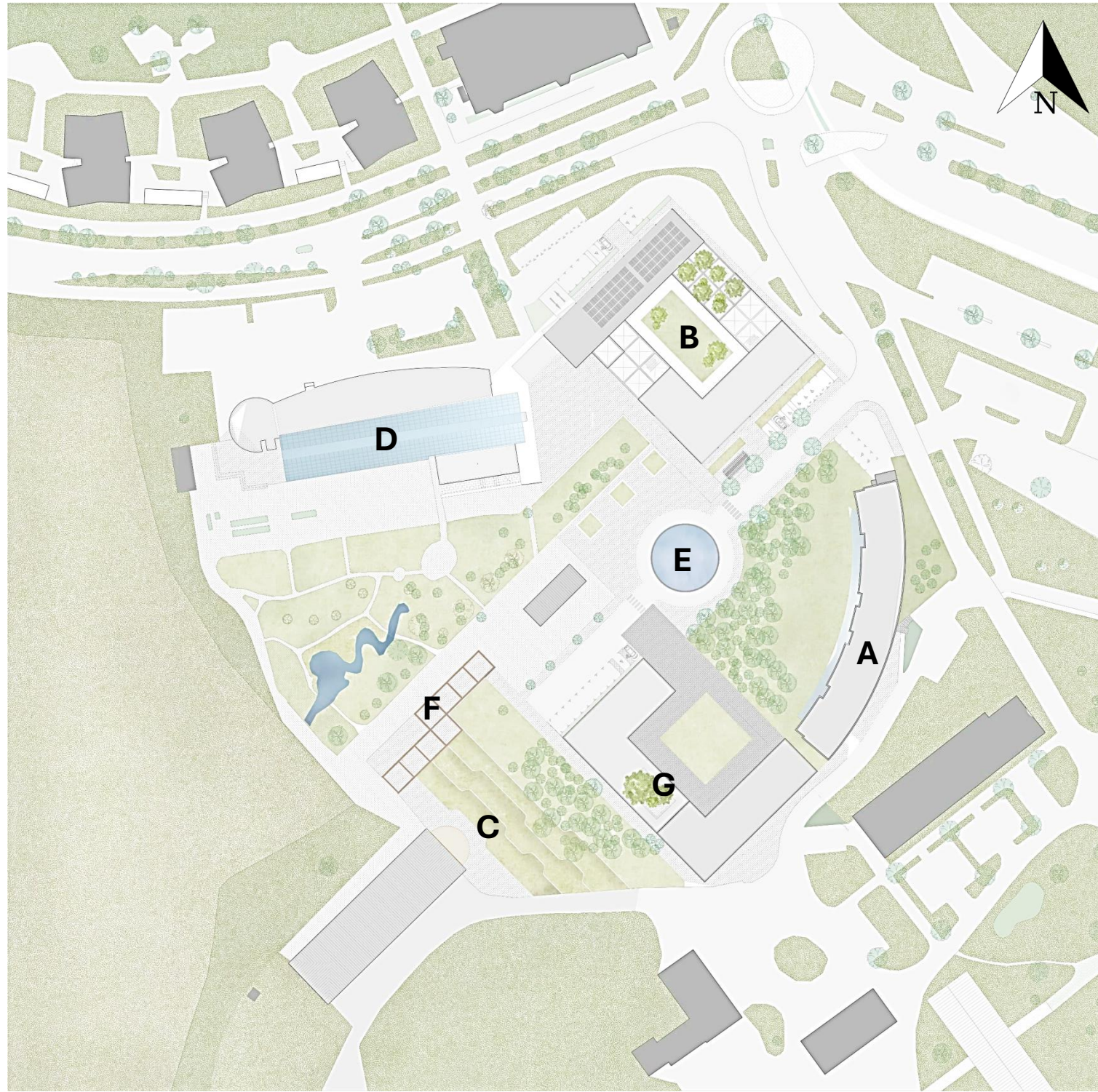
Viikki Campus, Koetilantie 5, 00790  
 Helsinki, Finland

# INITIAL MASSING

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# SITE PLAN



**A** – Renovated existing building

**B** – New build

**C** – Open air amphitheatre with old museum backdrop

**D** – Existing restaurant (remained untouched)

**E** – Ela centre

**F** – Summer pavilion

**G** – Winter pavilion

# ESTABLISHING DESIGN INTENTION

## SUSTAINABLE STRATEGIES



Standardised material sizes for effective re-use



Grid like system, designed for the building to easily adapt by expanding or retracting to meet changing needs



Timber is sourced locally, and is in-line with the vernacular building traditions of Finland



Designed to passively address climatic conditions, (stack-effect, thermal voids, maximising solar gains & natural light)



To subsidise the habitat loss at a ground level, the building will have multiple green spaces such as gardened terraces and roof-tops in line with the natural flora



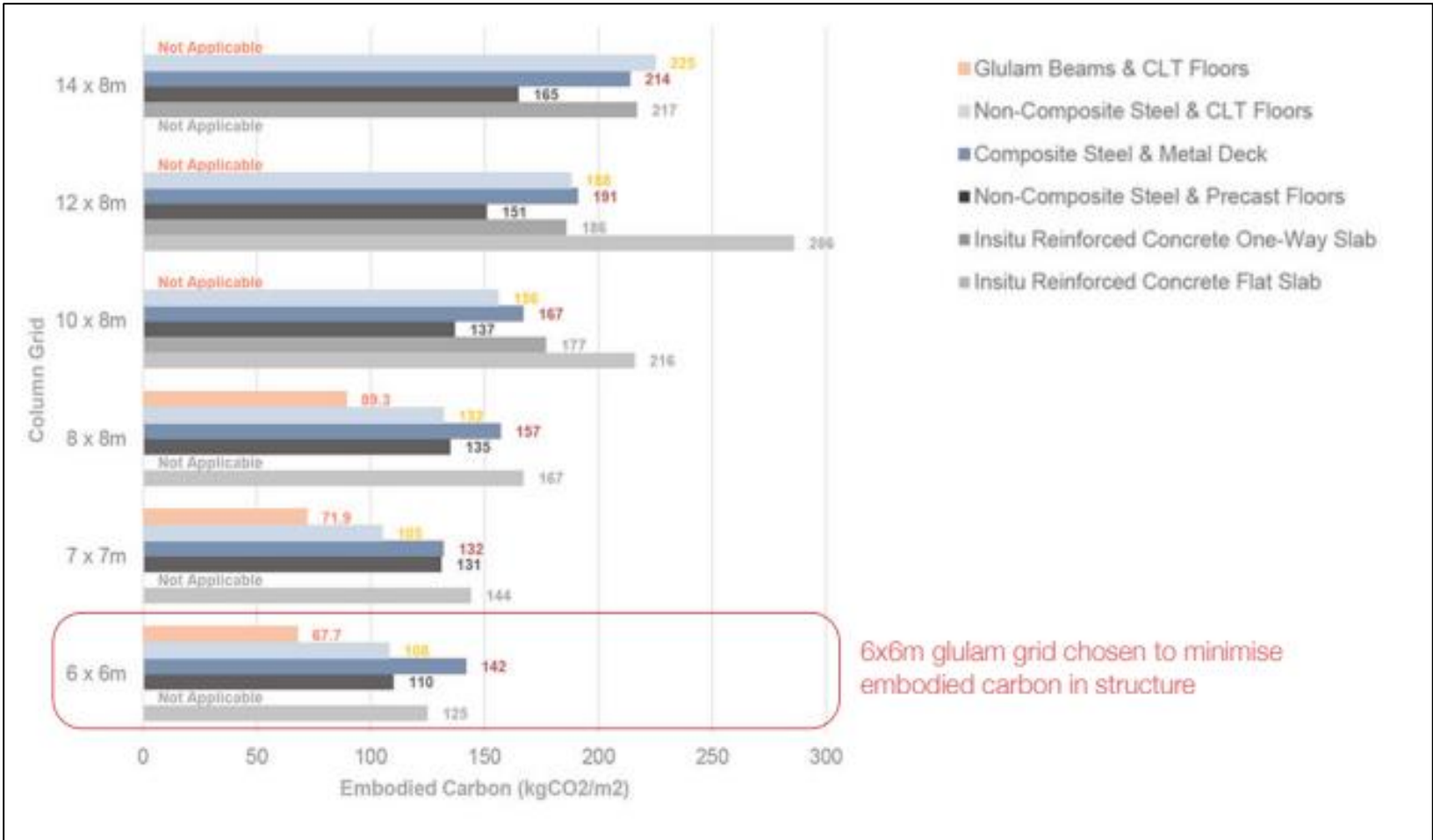
1. According to the LETI the superstructure accounts for around 48% of the buildings embodied energy



2. Glulam & CLT frames are preferable in EC terms up to a grid size of 8m x 8m, beyond which, beam sizes become excessively large to control serviceability requirements

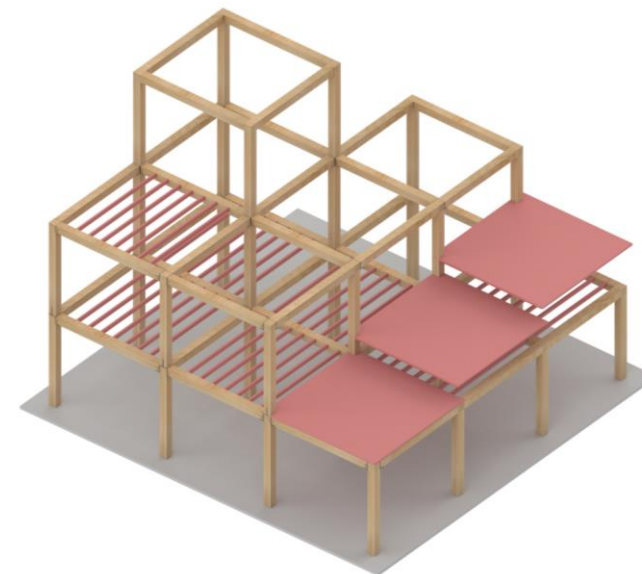
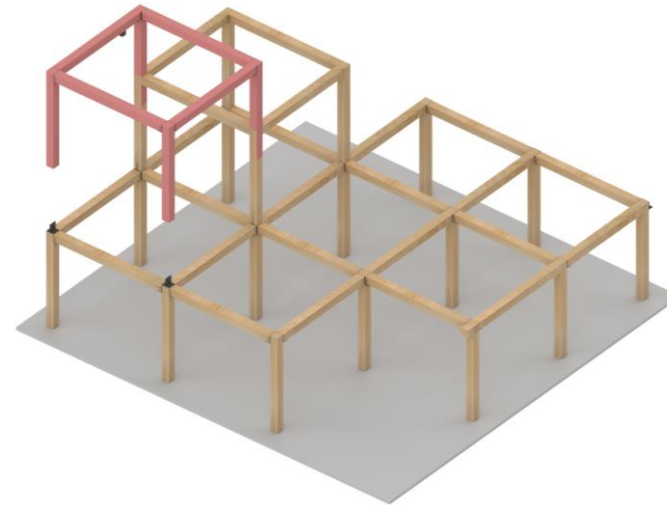
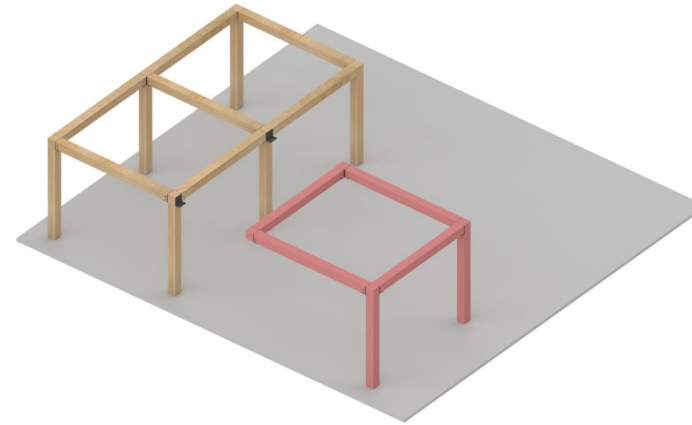
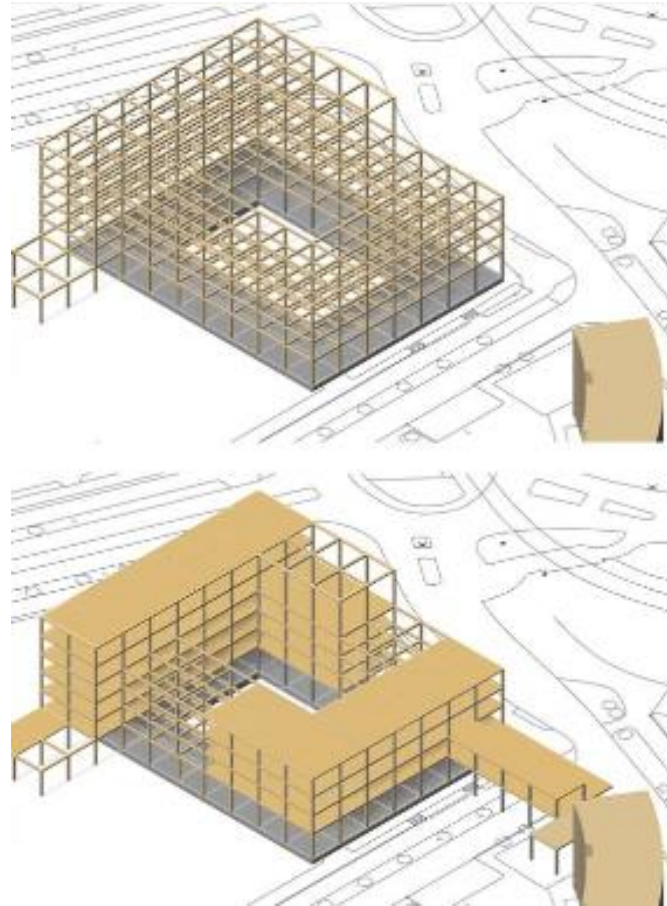


3. A tighter column grid will result in reduced embodied carbon emissions vs a sparse grid system



Typology	Column Grid Spacing (m)					
	6x6	7x7	8x8	8x10	8x12	8x14
In situ Reinforced Concrete Flat Slab	✓	✓	✓	✓	✓	N/A
In situ Reinforced Concrete One-Way Slab	N/A	N/A	N/A	✓	✓	✓
Non-composite Steel & Precast Floors	✓	✓	✓	✓	✓	✓
Composite Steel & Metal Deck	✓	✓	✓	✓	✓	✓
Non-composite Steel & CLT Floors	✓	✓	✓	✓	✓	✓
<b>Glulam Frame &amp; CLT Floors</b>	✓	✓	✓	N/A	N/A	N/A

# WHY CLT & GLULAM?



## Low embodied carbon

CLT- 0.25kgCO<sub>2</sub>/kg

Glulam- 0.28kgCO<sub>2</sub>/kg

## Renewable resource

Frame for easy disassembly and future use at end of life

Flexibility in growth and reduction of building

Timber leasing from FSC forests

## Prefabrication

Quicker and cheaper installation

Less CO<sub>2</sub> transport emissions

## Building performance

Acoustically reduces direct sound emissions

High degree of air tightness

Low thermal conductivity – CLT 0.12W/mK

– Glulam 0.13W/mK

# TIMBER LIFE CYCLE

## LEASING TIMBER



### TREES GROWN IN SUSTAINABLE FORESTS

When trees are cut down, a lease is issued by the forest trust to rent wood out for construction use

### TREES MADE INTO ENGINEERED TIMBER

Data on the leased timber includes CO2 stored and material specification

### BUILDINGS ARE FABRICATED AND ASSEMBLED

The lease requires timber parts to be designed for assembly, reducing waste and loss of stored carbon

### BUILDINGS ARE OCCUPIED AND MAINTAINED

Obligations are outlined in the material lease to care for the timber

### BUILDINGS ARE DECONSTRUCTED

Buildings are carefully disassembled into its components, so the maximum amount of material is reused

### TIMBER IS REUSED IN NEW BUILDINGS

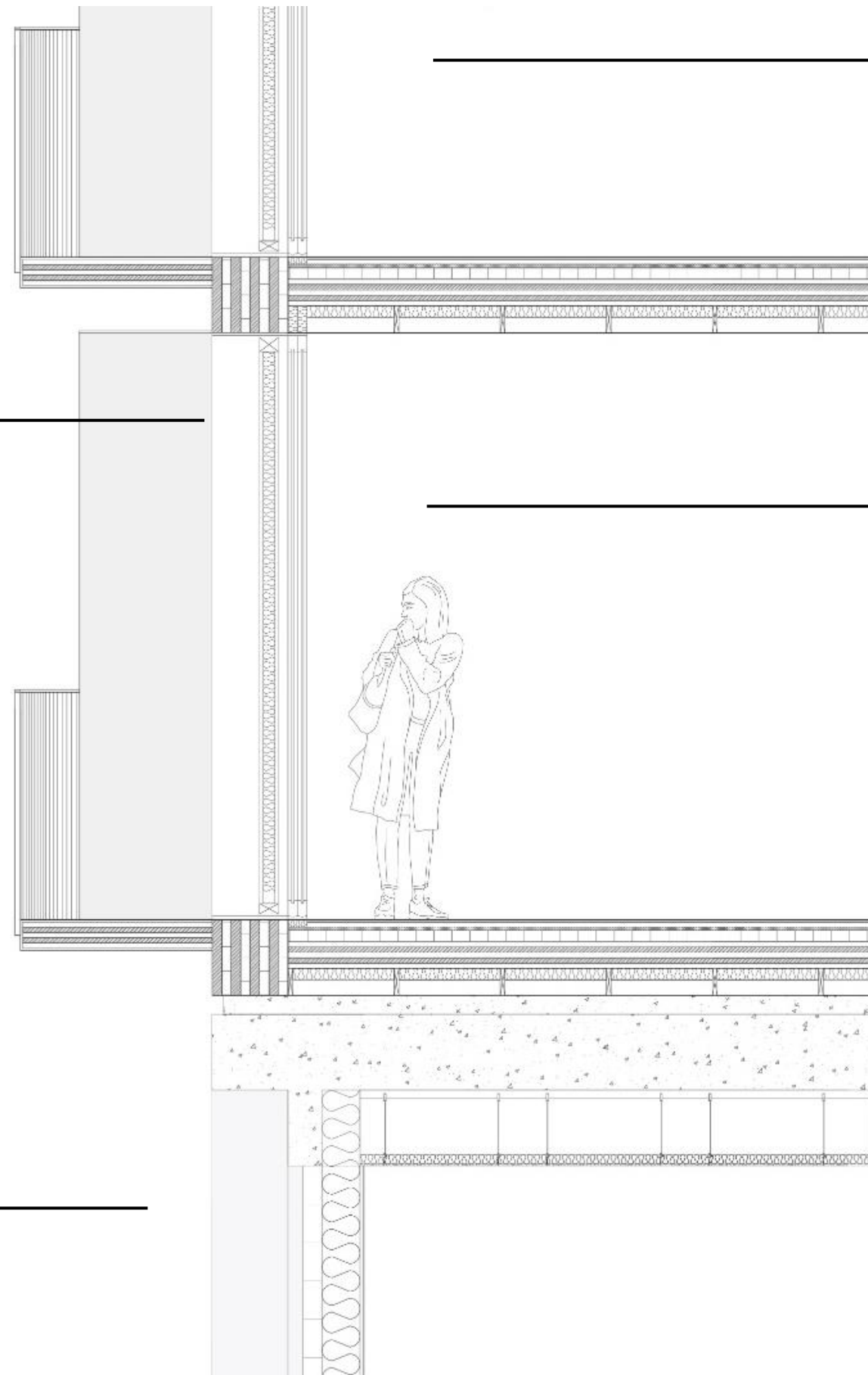
The leased timber is transferred to the next building. Reuse avoids using new resources and keeps carbon stored

### TIMBER IS RECYCLED OR DISPOSED

Timber that can't be reused is recycled into durable products. Unrecyclable timber is disposed in a way that locks in carbon



# MATERIALS



EXTERNAL WALL		
CLT	50	mm
Glulam beam	150	mm
Isover Multimax 30 glass mineral wool insulation	200	mm
Damp proof membrane	x	mm
SIP board	50	mm
Gyproc Gypsum Plasterboard	15	mm
<b>U value</b>	<b>0.103</b>	<b>W/m²K</b>

GLAZING FRAME		
Timber Shutters	50	mm
SIP Panel	50	mm
Gyproc Gypsum Plasterboard	15	mm
Timber frame	200	mm
Airtight tape bonded to frame	X	X
Foam air seal	X	X
<b>U value</b>	<b>0.7</b>	<b>W/m²K</b>

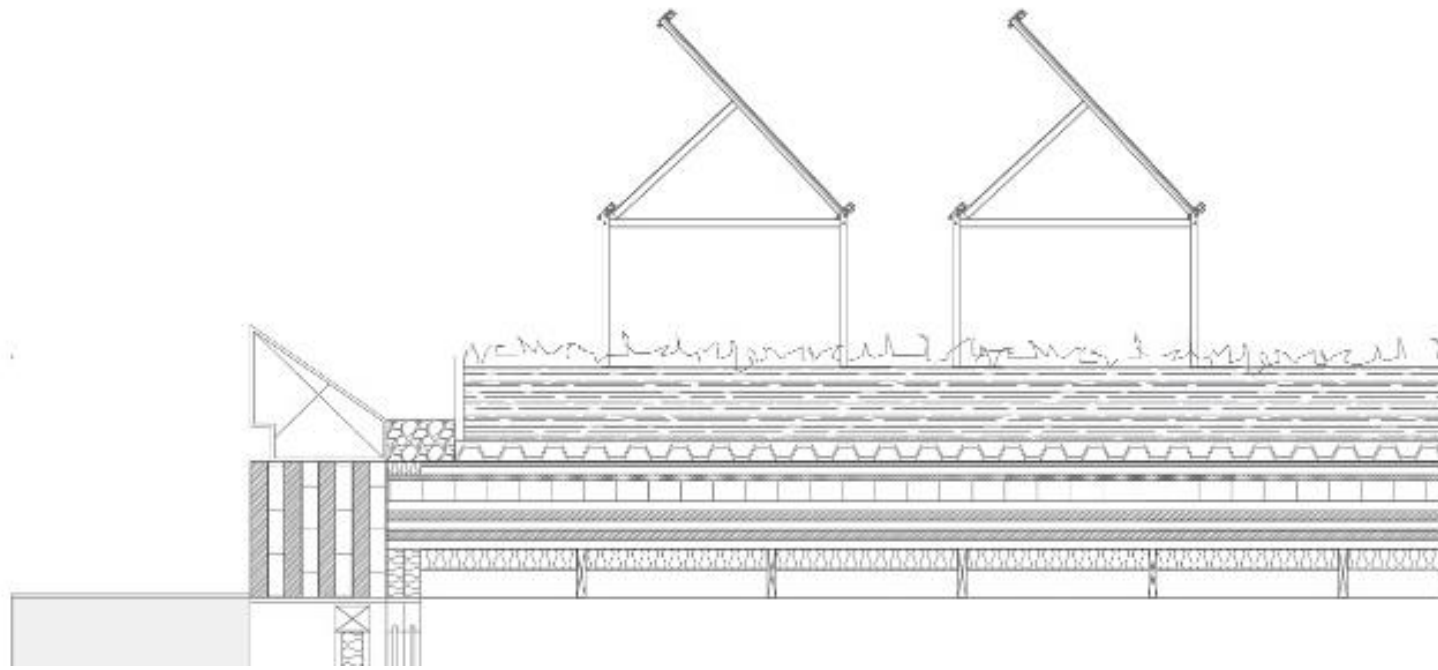
GLAZING		
Triple Glazed Saint-Gobain Cool-lite Xtreme		
Argon filling		
<b>U value</b>	<b>0.7</b>	<b>W/m²K</b>

BALCONY		
Aluminium rail	X	mm
Thermal break to minimise thermal bridging	X	mm
Aluminium frame	50	mm
CLT cantilever	100	mm
<b>U value</b>	<b>0.25</b>	<b>W/m²K</b>

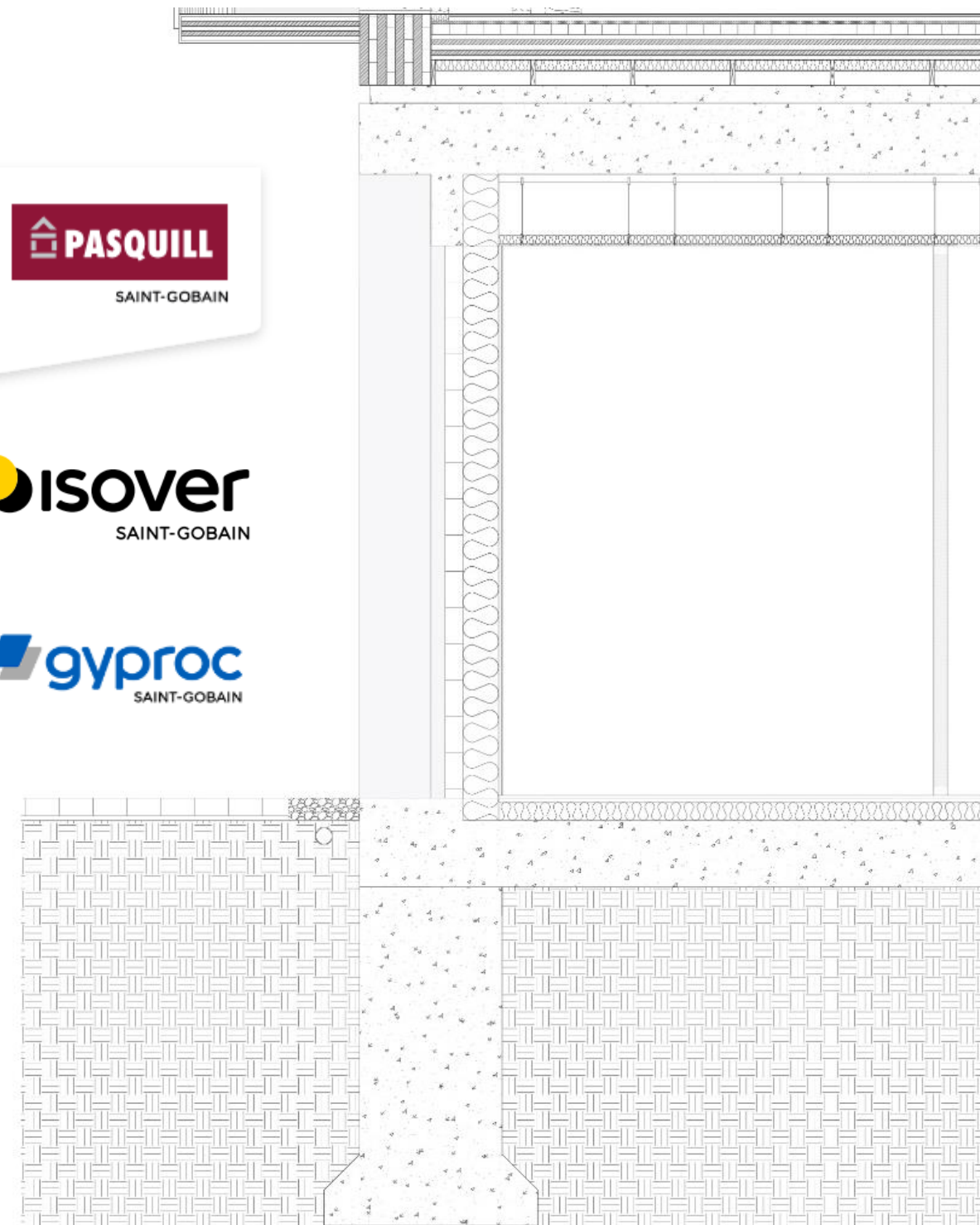
INTERNAL FLOOR/ CEILING		
NOISE REDUCTION		
Floor finish	X	X
Prosound Dry screed layer	50	dB
Mineral wool	40	dB
Airtight membrane	X	X
SIP panels	58	dB
Concrete slab (GF ONLY)	50	dB
Glulam floor joists (FLOOR 1-5)	45	dB
Air cavity (FOR HVAC)	X	X
Gyproc Gypsum plasterboard	40	dB
<b>AVERAGE</b>	<b>48</b>	<b>dB</b>

GROUND FLOOR EXTERNAL WALL		
Concrete Brick	100	mm
Isover Multimax 30 glass mineral wool insulation	200	mm
Damp proof membrane	X	mm
Gyproc Gypsum Plasterboard	15	mm
<b>U value</b>	<b>0.119</b>	<b>W/m²K</b>

# MATERIALS



ROOF		
Green roof with solar panels	X	mm
Drainage element, water reservoir, root barrier	X	mm
Smooth gravel channel edge	100	mm
Prosound dry screed later	25	mm
Damp proof membrane	X	mm
Thermal break to minimise thermal bridging	X	mm
5-layer CLT	100	mm
Glulam floor joists	150	mm
Isover Multimax 30 glass mineral wool insulation	200	mm
SIP panel	50	mm
Gyproc Gypsum plasterboard	15	mm
<b>U value</b>	<b>0.095</b>	<b>W/m²K</b>



INTERNAL WALL		
NOISE REDUCTION		
Gyproc Gypsum plaster finish	40	dB
SIP Panels	58	dB
Gyproc Gypsum plaster finish	40	dB
<b>AVERAGE</b>	<b>46</b>	<b>dB</b>

GROUND FLOOR		
Treated timber floor	15	mm
Prosound dry screed layer	25	mm
Damp proof membrane	X	mm
Isover Multimax 30 glass mineral wool insulation	100	mm
Existing concrete (reused)	100	mm
<b>U value</b>	<b>0.105</b>	<b>W/m²K</b>

# NEW BUILDING



# PAVILIONS & AMPHITHEATRE



# EXISTING BUILD



# NEW BUILD- GROUND FLOOR



# NEW BUILD- FIRST FLOOR



# CURVED BUILDING

S F

F F

G F

Staircase



1 bed apartments



Staircase  
Elevator  
Fire escape  
Toilet area



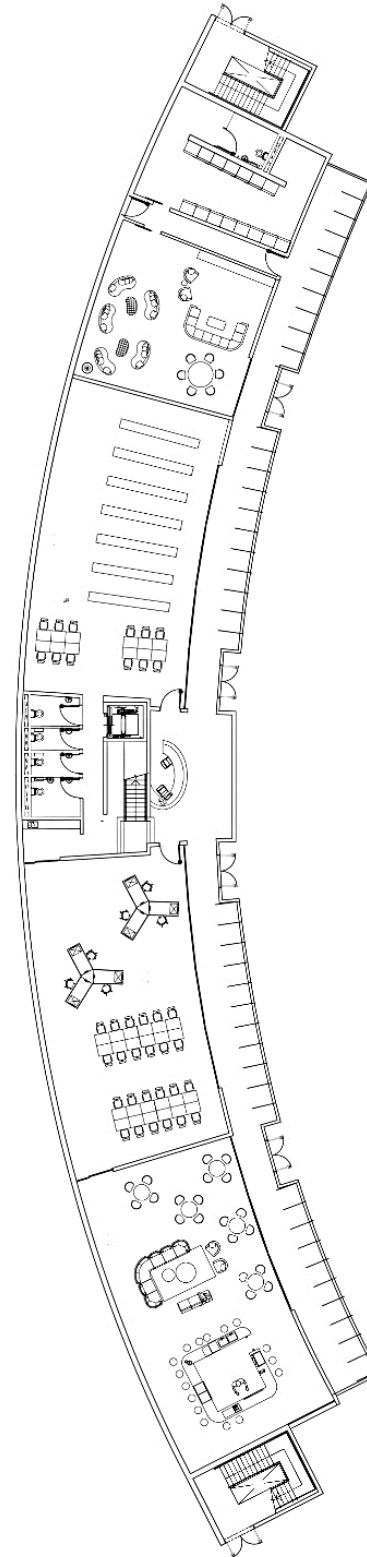
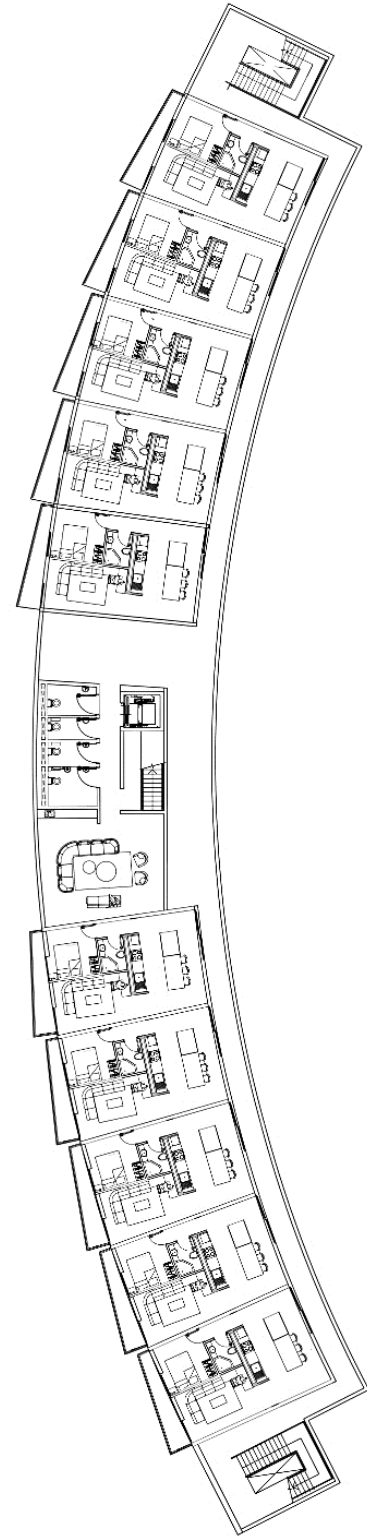
Meeting space



1 bed apartments



Staircase



Staircase



Lauderette



Entertaining common room



Archive deposit



Toilet area  
Lounge space  
Staircase  
Elevator



Office area

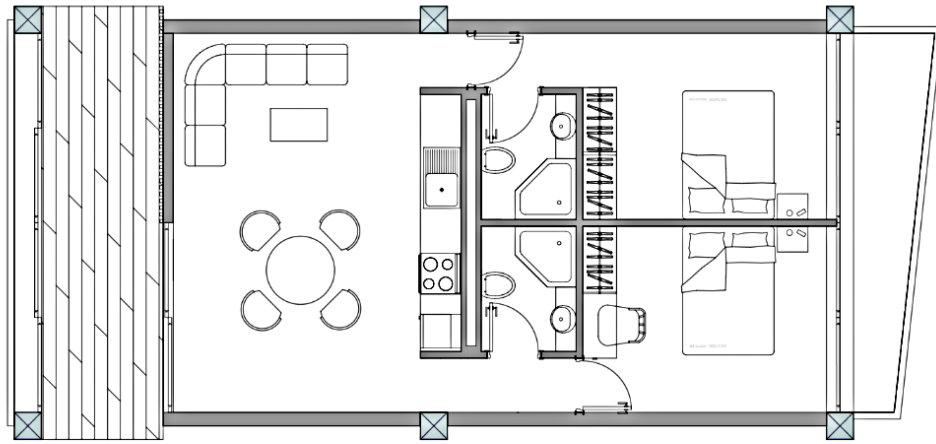


Functional common room



Staircase

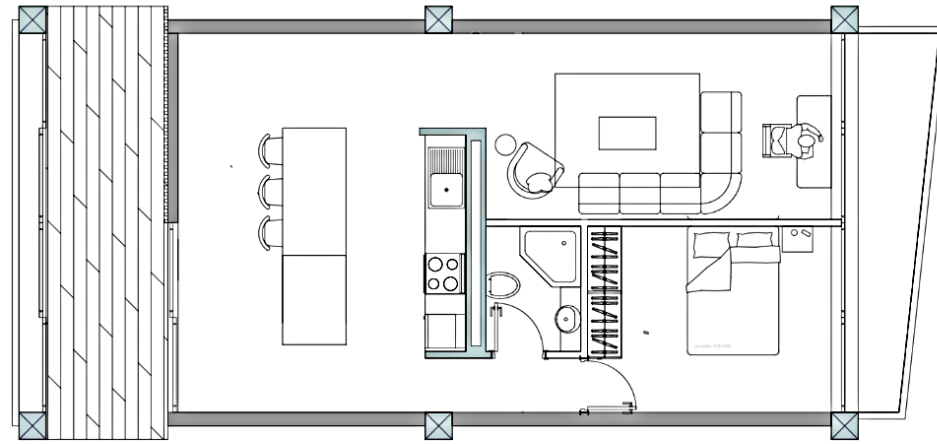
# FLOOR PLANS



UNIT 1 (61 sqm)



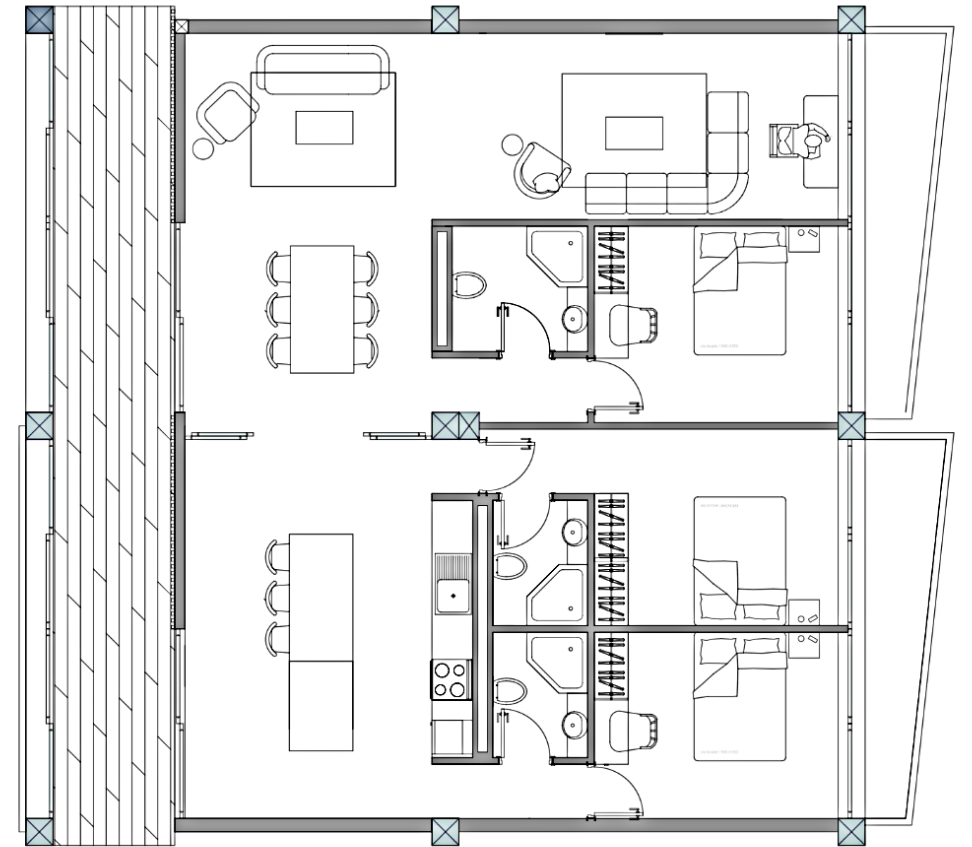
2 Bed en-suite flat,  
Typically for students or  
young adults.



UNIT 2 (61 sqm)



1 Bed en-suite studio,  
For mature students &  
young adults



UNIT 3 (122 sqm)



3 Bed en-suite flat,  
For house-share & young  
families.

3 - BEDROOM

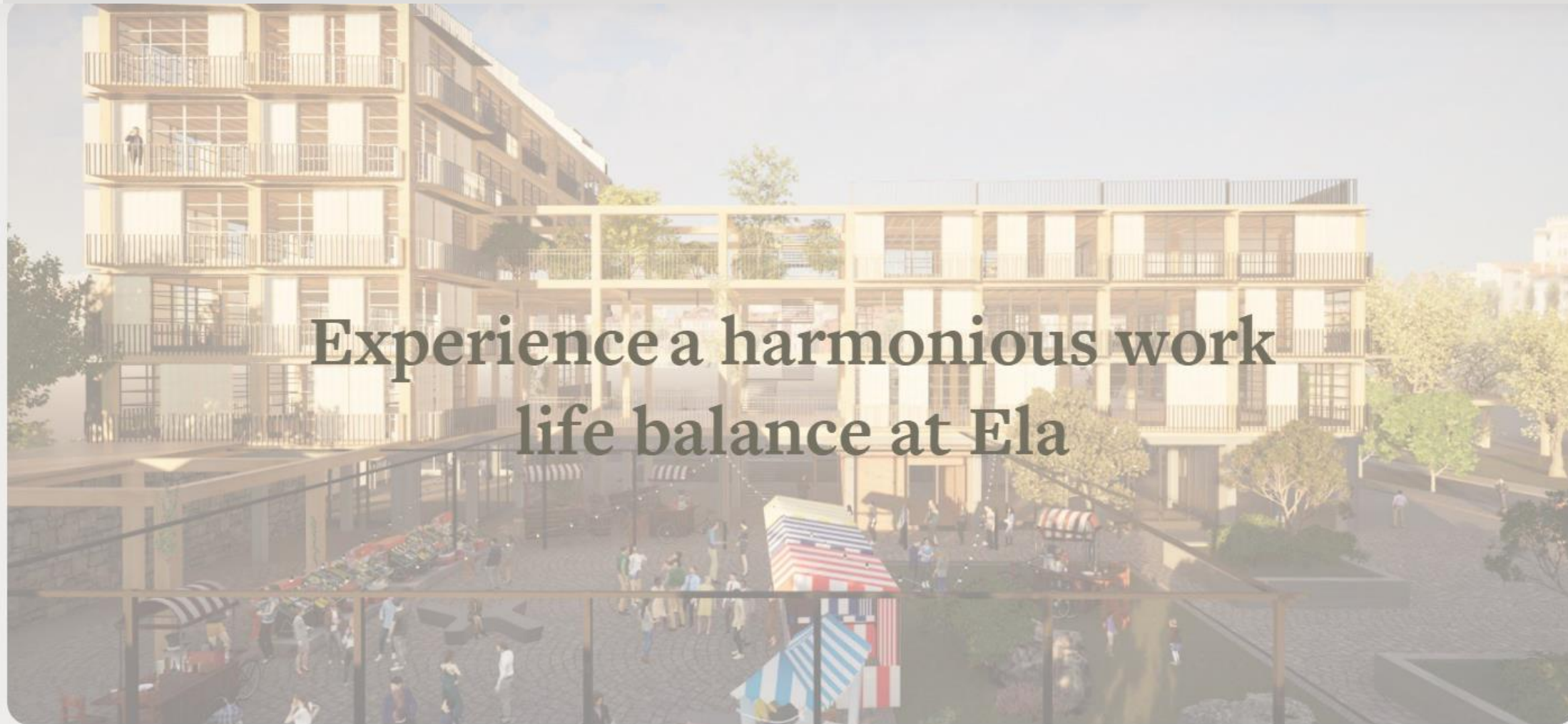


2 - BEDROOM



1 - BEDROOM





## Experience a harmonious work life balance at Ela

### What we offer

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Relax +

---

Socialise +

---

Live +

---

Sustainable +

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Entertain -

With our multi-functional ground floor space, you can transform it from a bar to a library to an office to a hang-out space. Our wider site can offer ample entertainment areas such as our amphitheatre performances, as well as our outdoor exercise equipment built to generate energy with every use.

#### 1-bed apartment

Embrace single living at 750€/mnth

- Single double-bed bedroom
- Private bathroom and storage room
- Kitchen and living area
- Communal corridor
- Ample amounts of natural daylight
- Adjustable ventilation and temperature
- Smart controls and sensors for lighting, HVAC, and air quality.

#### 3-bed apartment

Opt for luxurious living at 1750€/mnth

- Three double-bed bedroom
- Private bathroom and storage room each
- Kitchen and living area
- Communal corridor
- Ample amounts of natural daylight
- Adjustable ventilation and temperature
- Smart controls and sensors for lighting, HVAC, and air quality.

#### 2-bed apartment

Engage in double living at a fee of 950€/mnth

- Two double-bed bedroom
- Private bathroom and storage room each
- Kitchen and living area
- Communal corridor
- Ample amounts of natural daylight
- Adjustable ventilation and temperature
- Smart controls and sensors for lighting, HVAC, and air quality.



Scan me!

“Embrace the beauty of your evolving story, just like Ela embraces sustainable cohabitated lifestyles. The future will naturally fall into place, as living at Ela supports you every step of the way.”

— With love from Ela



# PASSIVE STRATEGIES

## NEW BUILDING

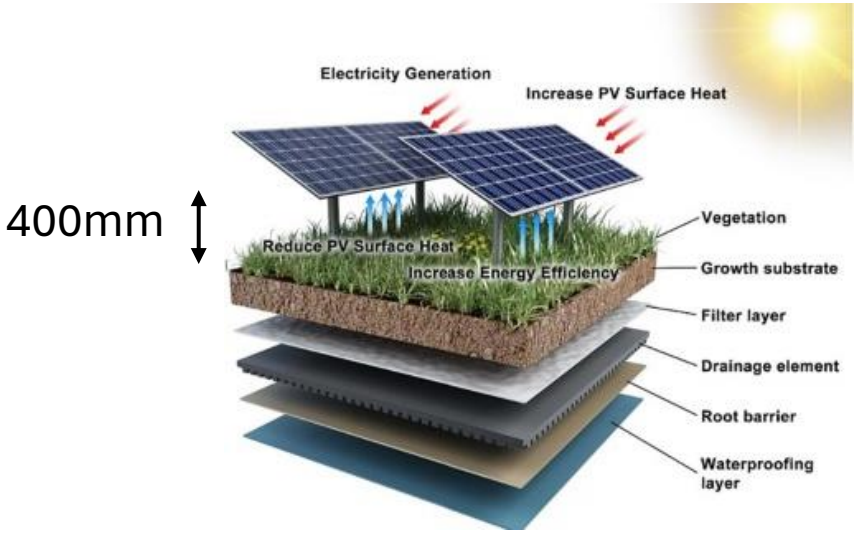
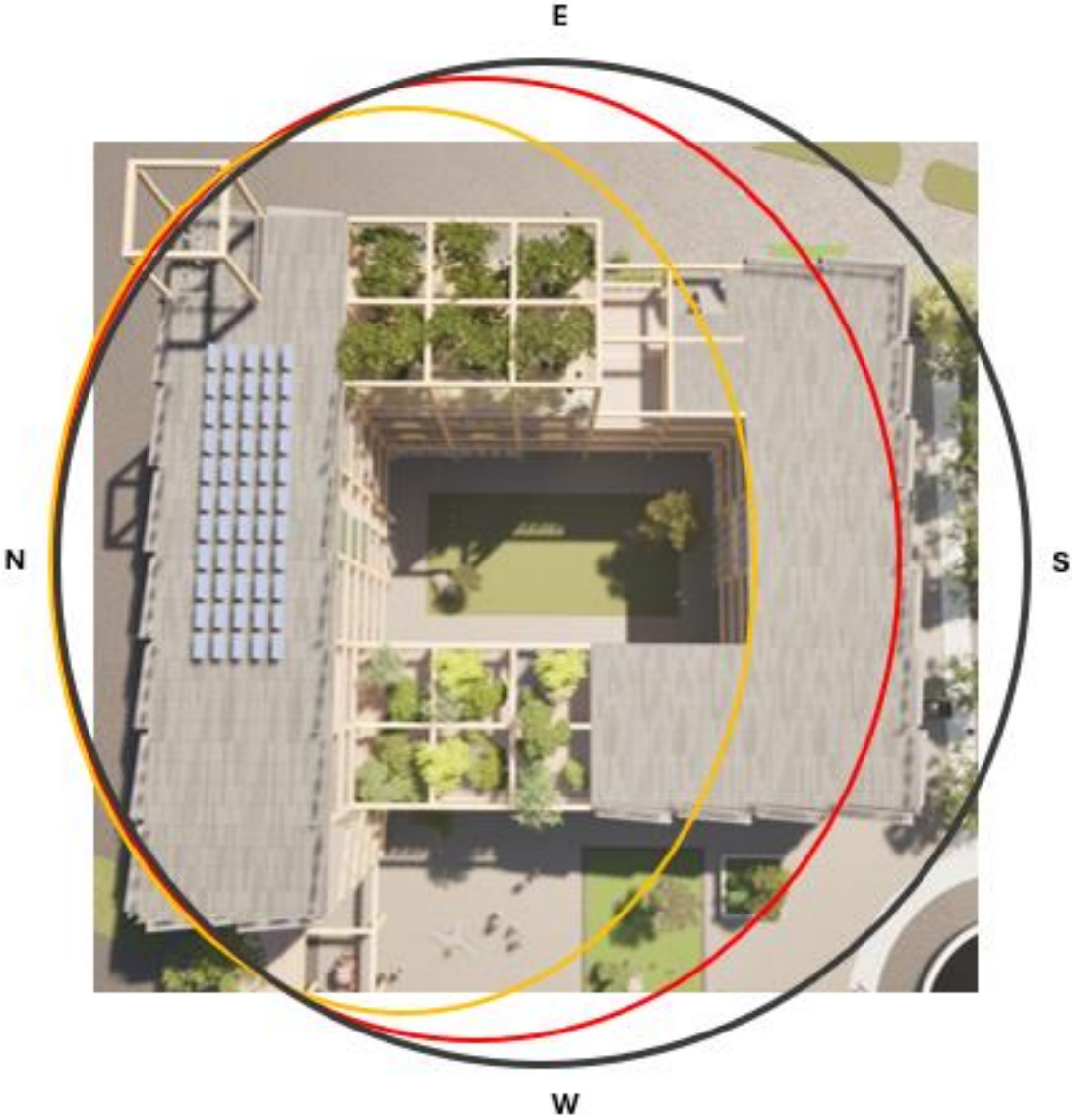
### BIODIVERSITY ROOFS



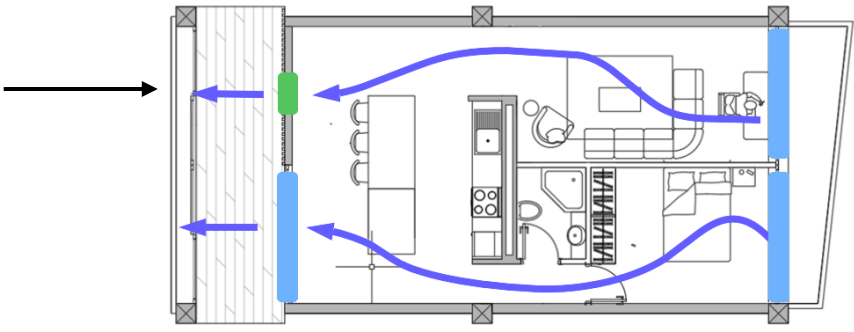
### CROSS FLOW VENTILATION ATRIUM STACK VENTILATION



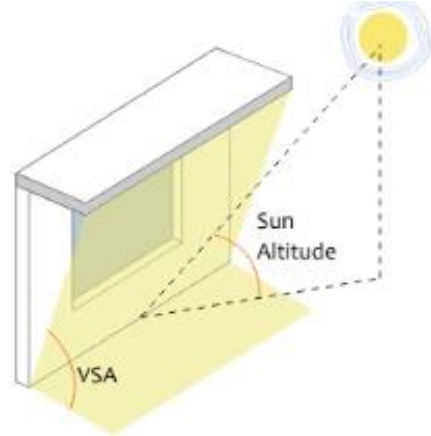
### DAYLIGHT & SHADING



### Grill



### Openable glass doors



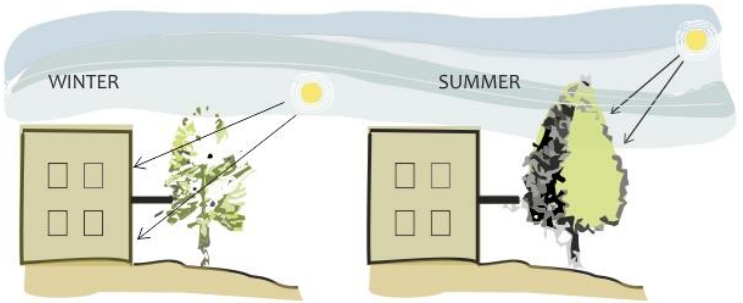
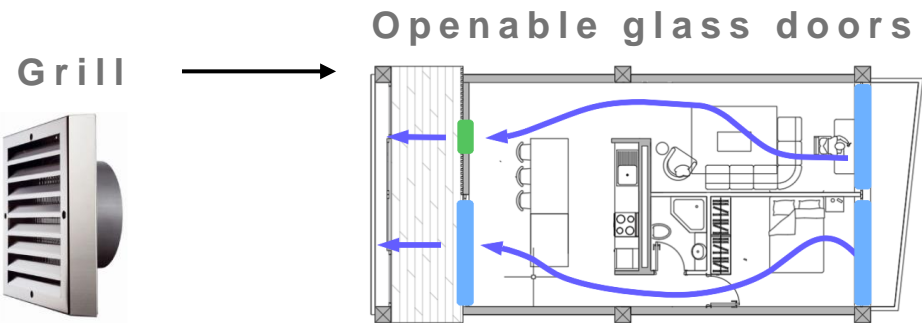
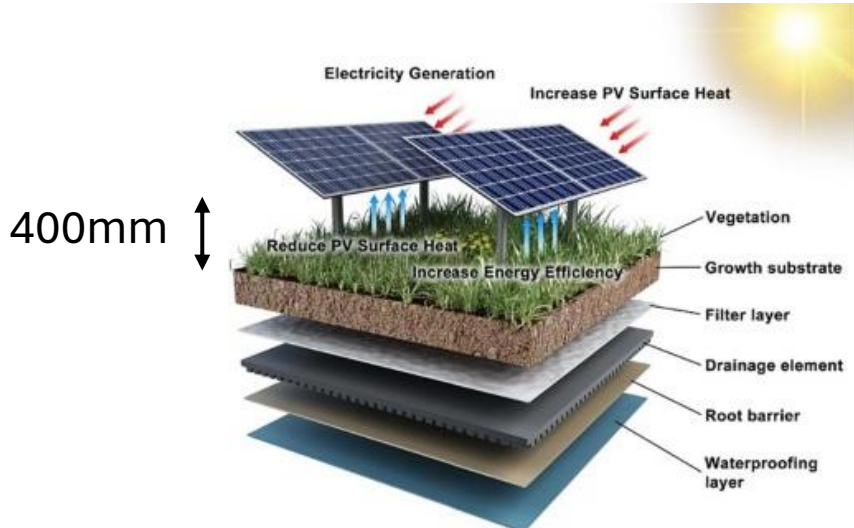
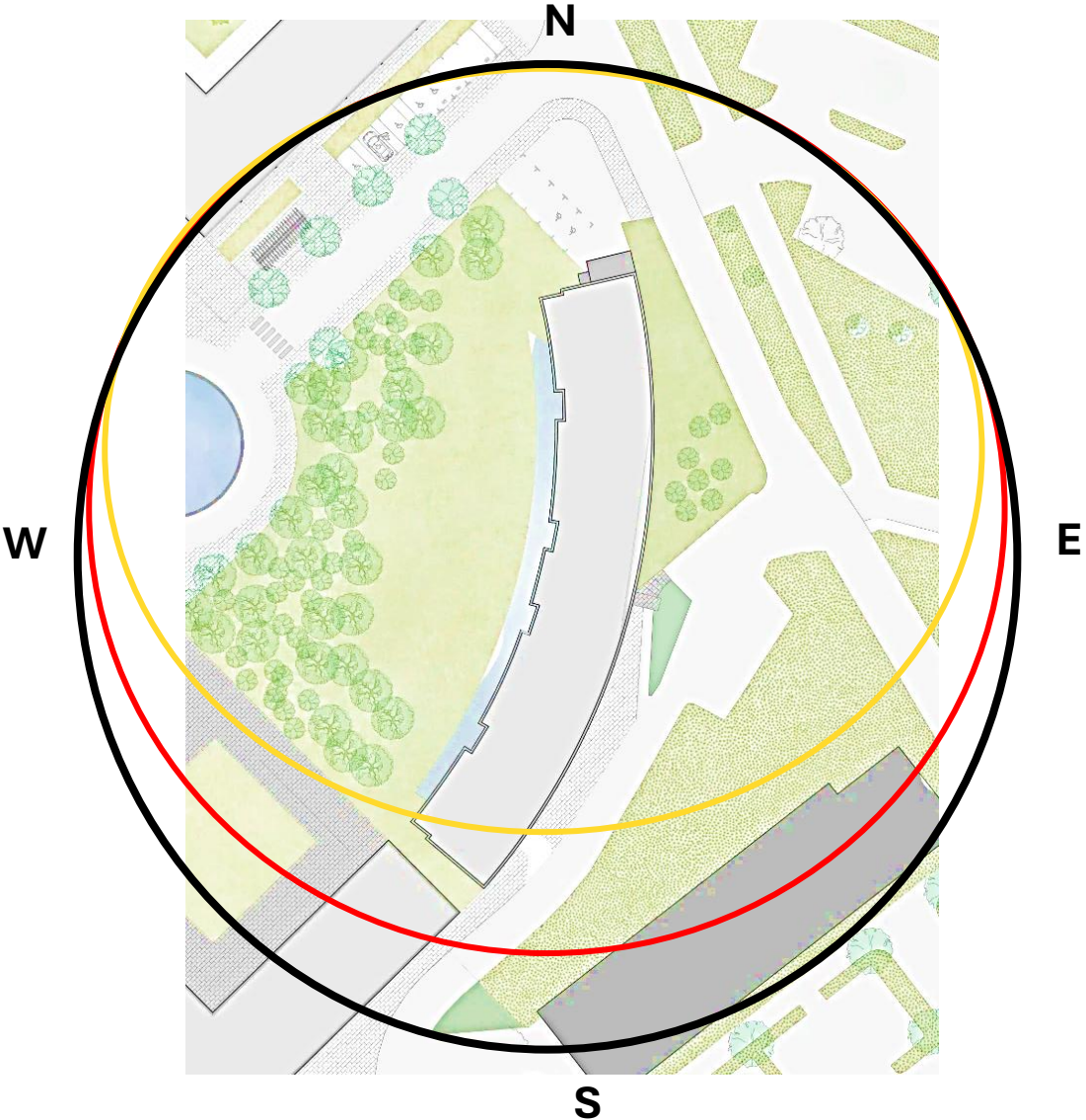
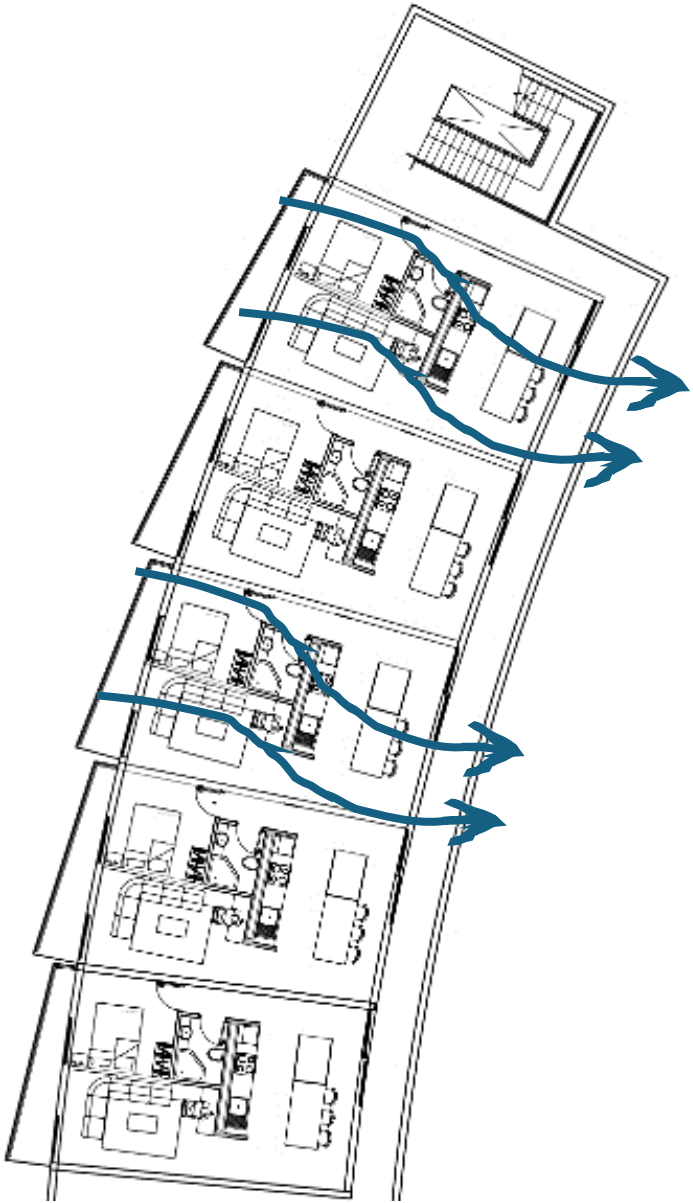
# PASSIVE STRATEGIES

REFURBISHED BUILDING

BIODIVERSITY ROOFS

CROSS FLOW VENTILATION

DAYLIGHT & SHADING



# RENEWABLES

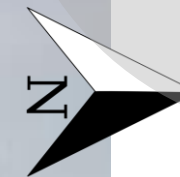


**WIND**

Energy generation: 1,300 kWh/yr

**SOLAR PANELS**

Energy generation: 32,000 kWh/yr



**PAVEGEN**



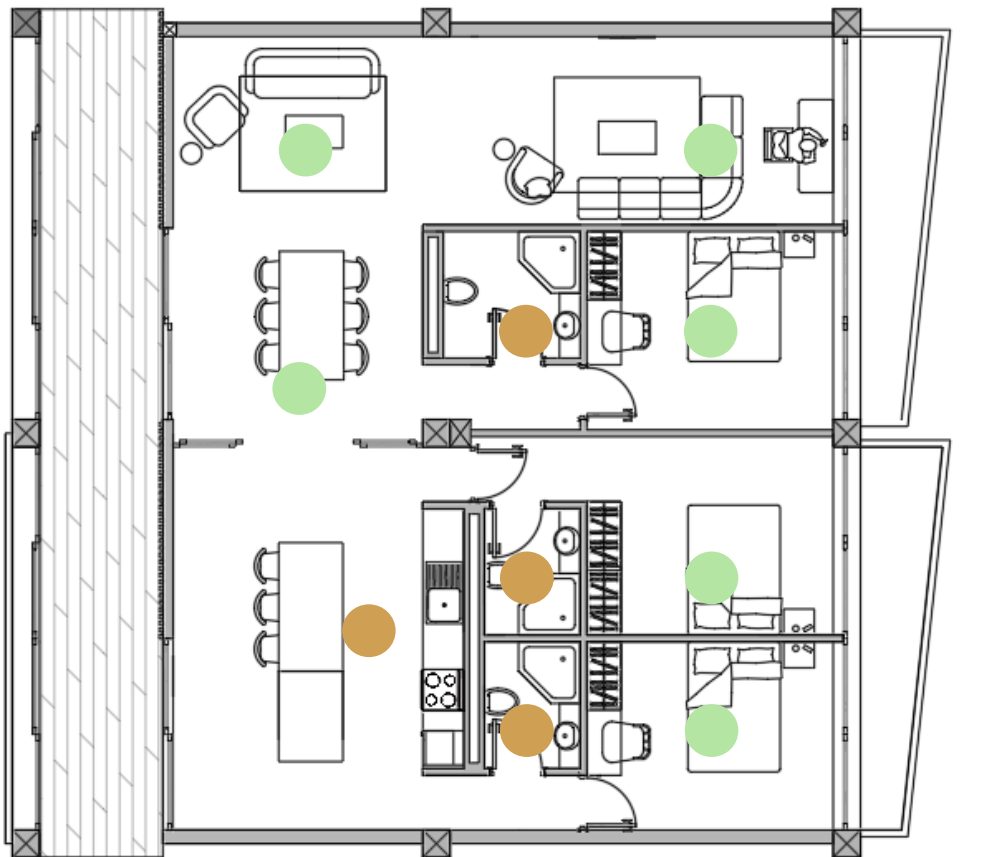
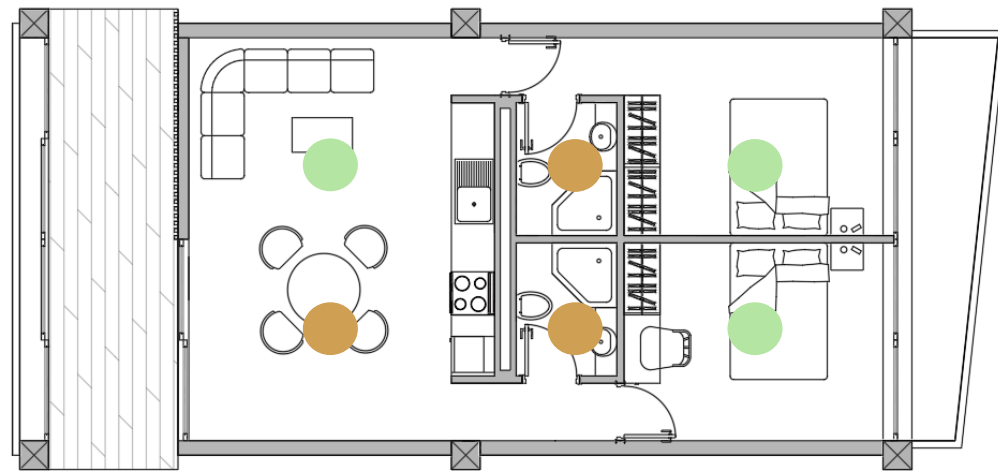
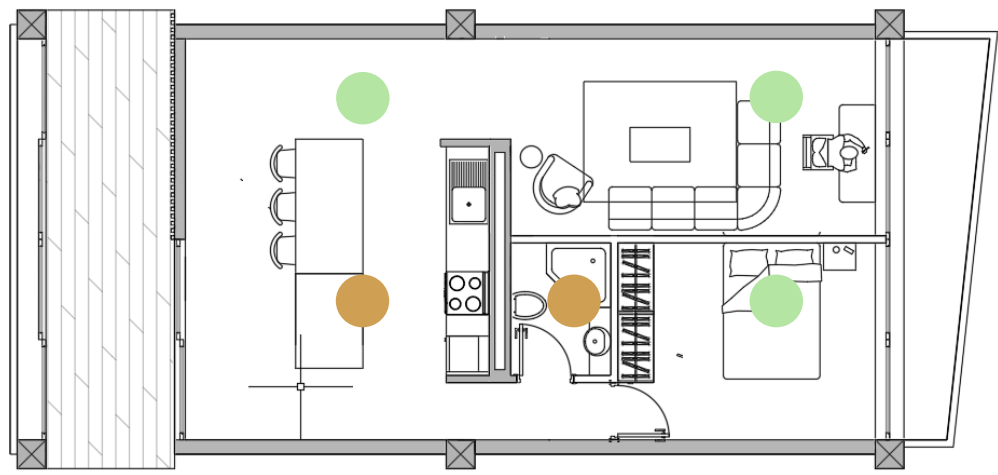
Energy generation: 9,700 kWh/yr

**GSHP**

Energy generation: Remaining building demand



# MVHR



Exhaust air

Outdoor air

Supply diffuser



Supply air

Extract air

IAQ sensor

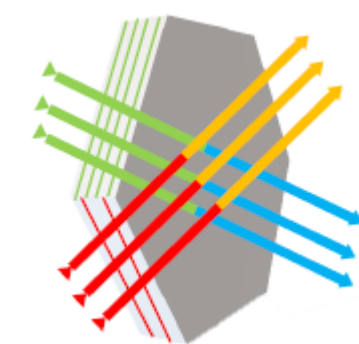


Control for MVHR



Passivhaus heat recovery MVHR

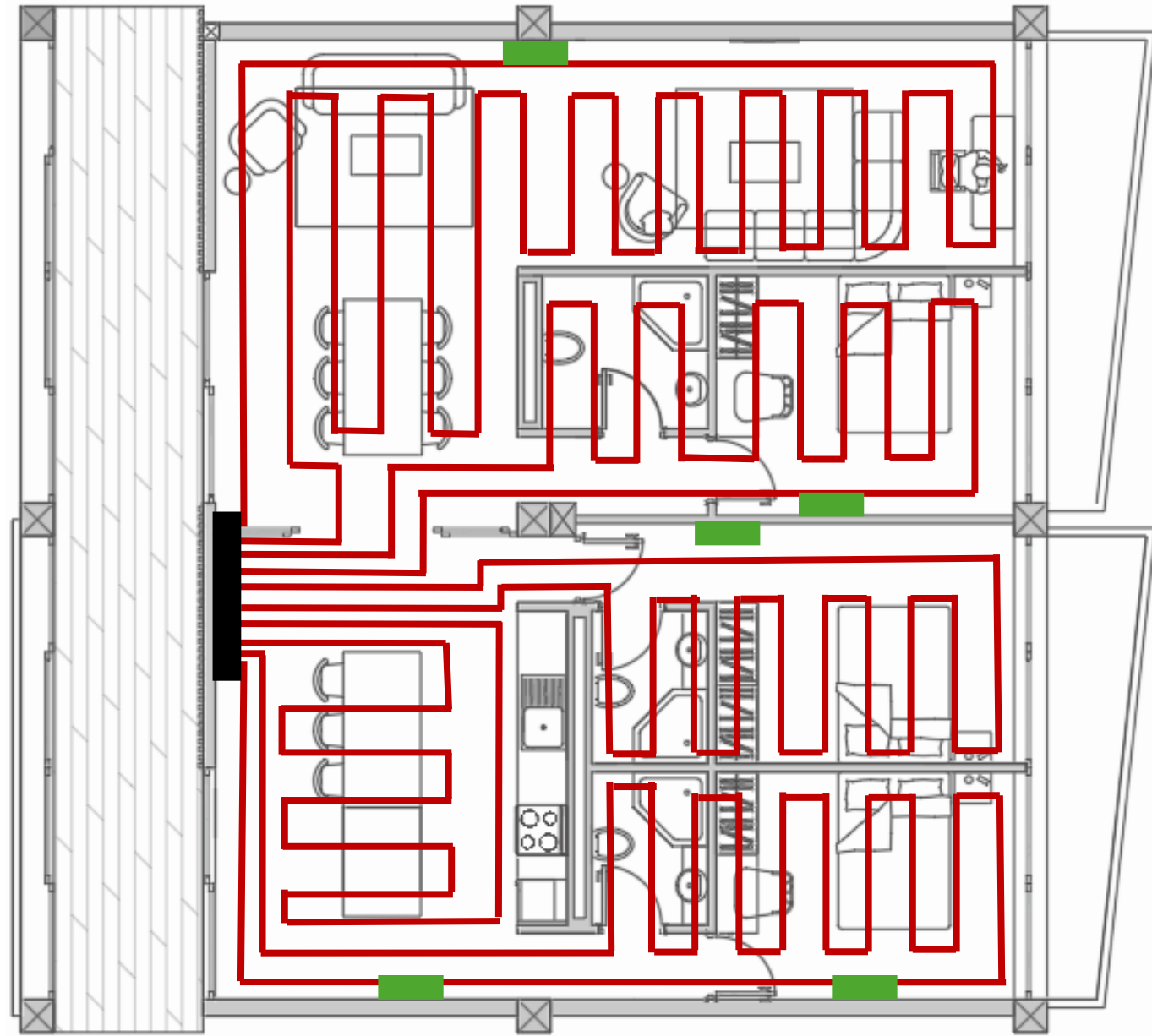
Extract diffuser



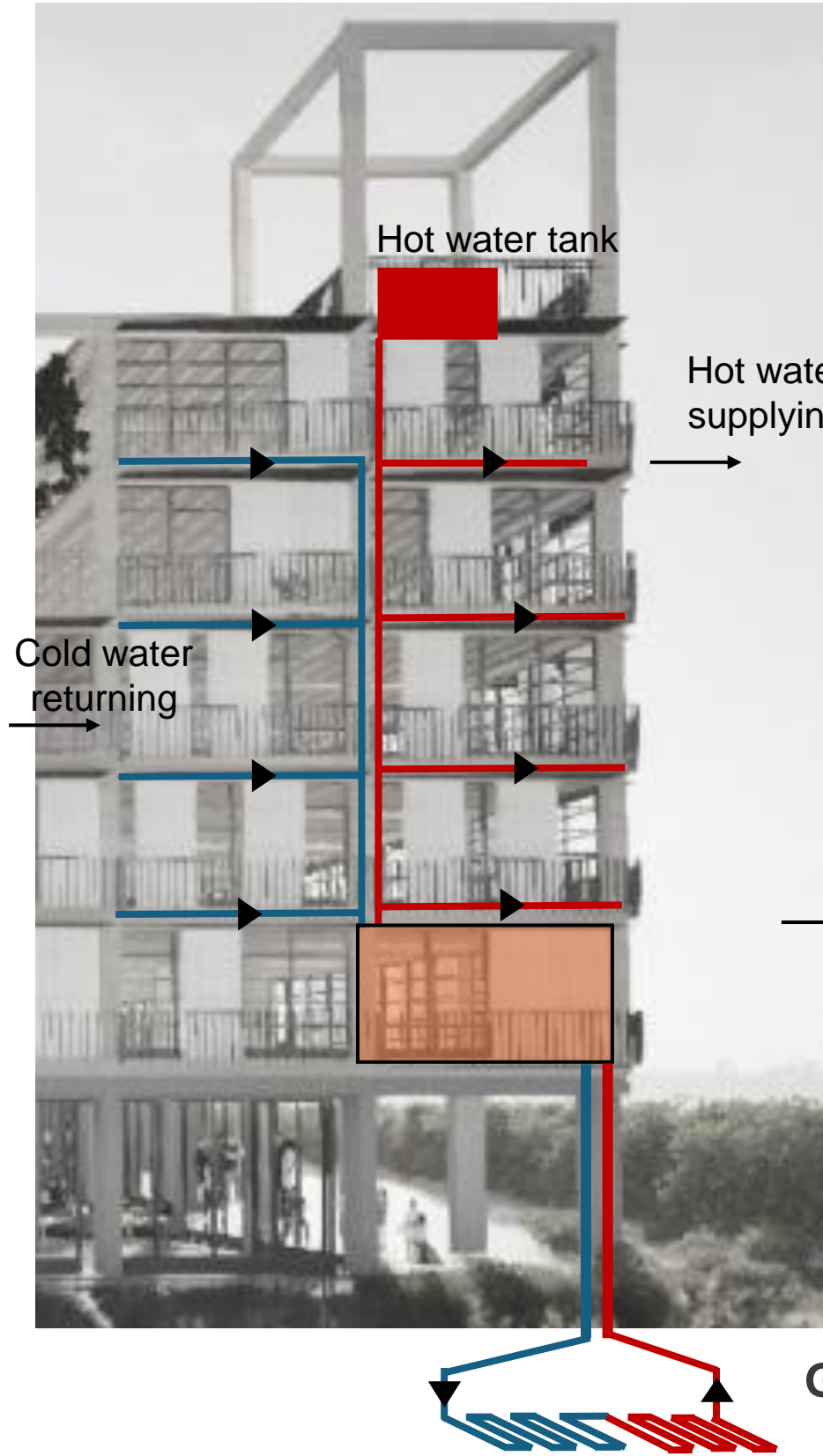
featuring boost ventilation for future scenarios

# HEATING NEW BUILD

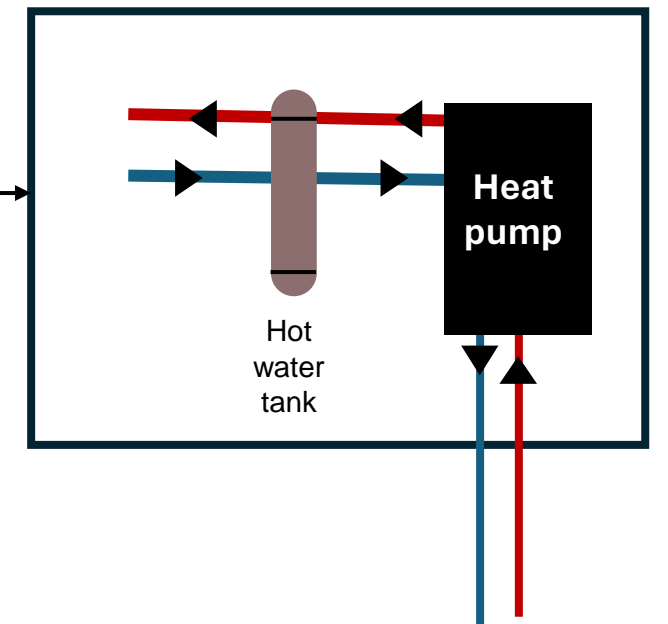
### Underfloor heating



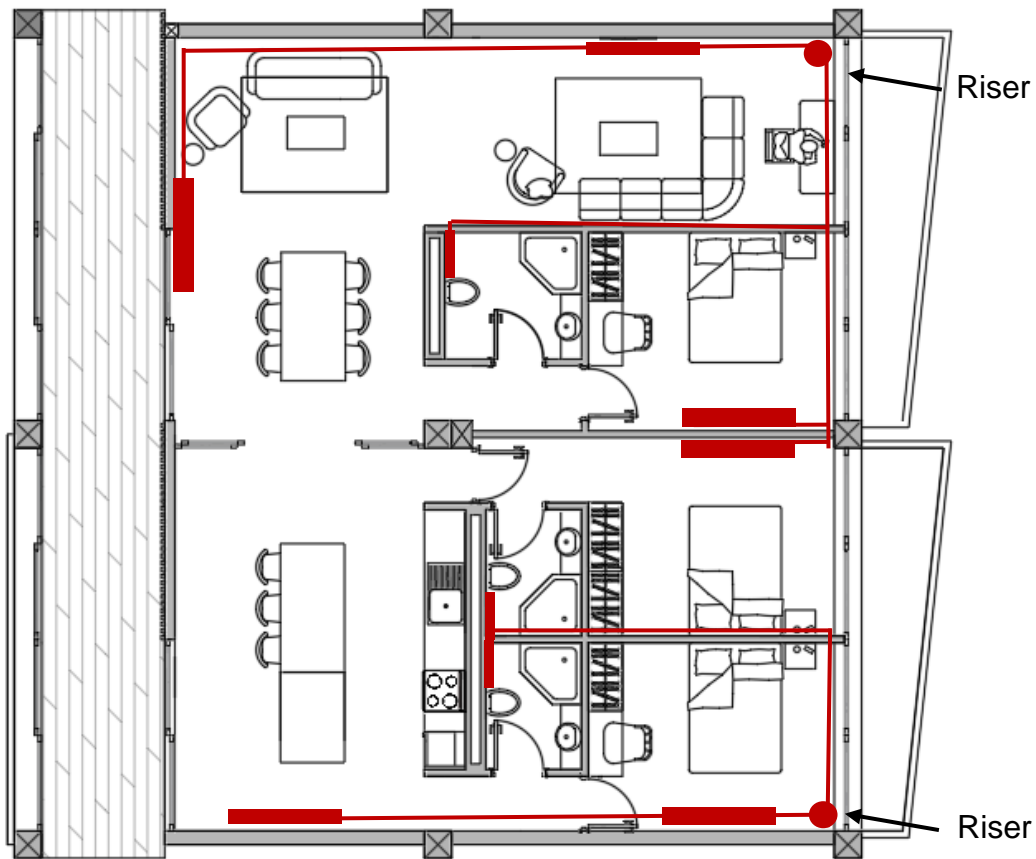
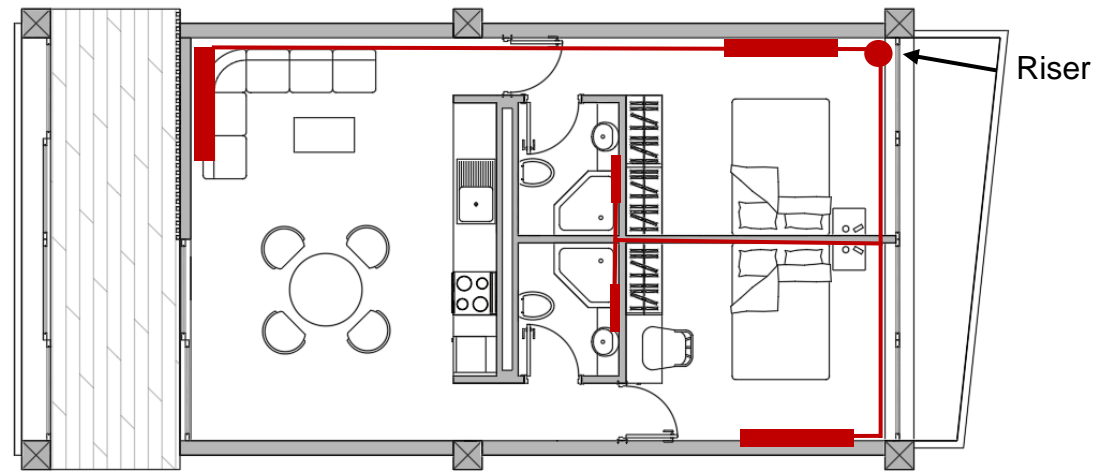
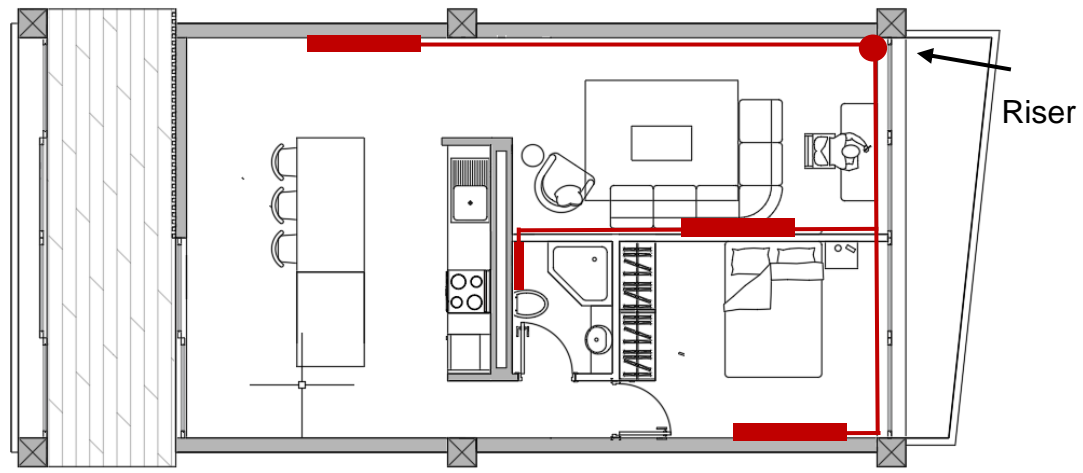
Thermostat control for each zone



- Provides high level of thermal comfort
- Works well with GSHP
- Gives flexibility to the furniture layout

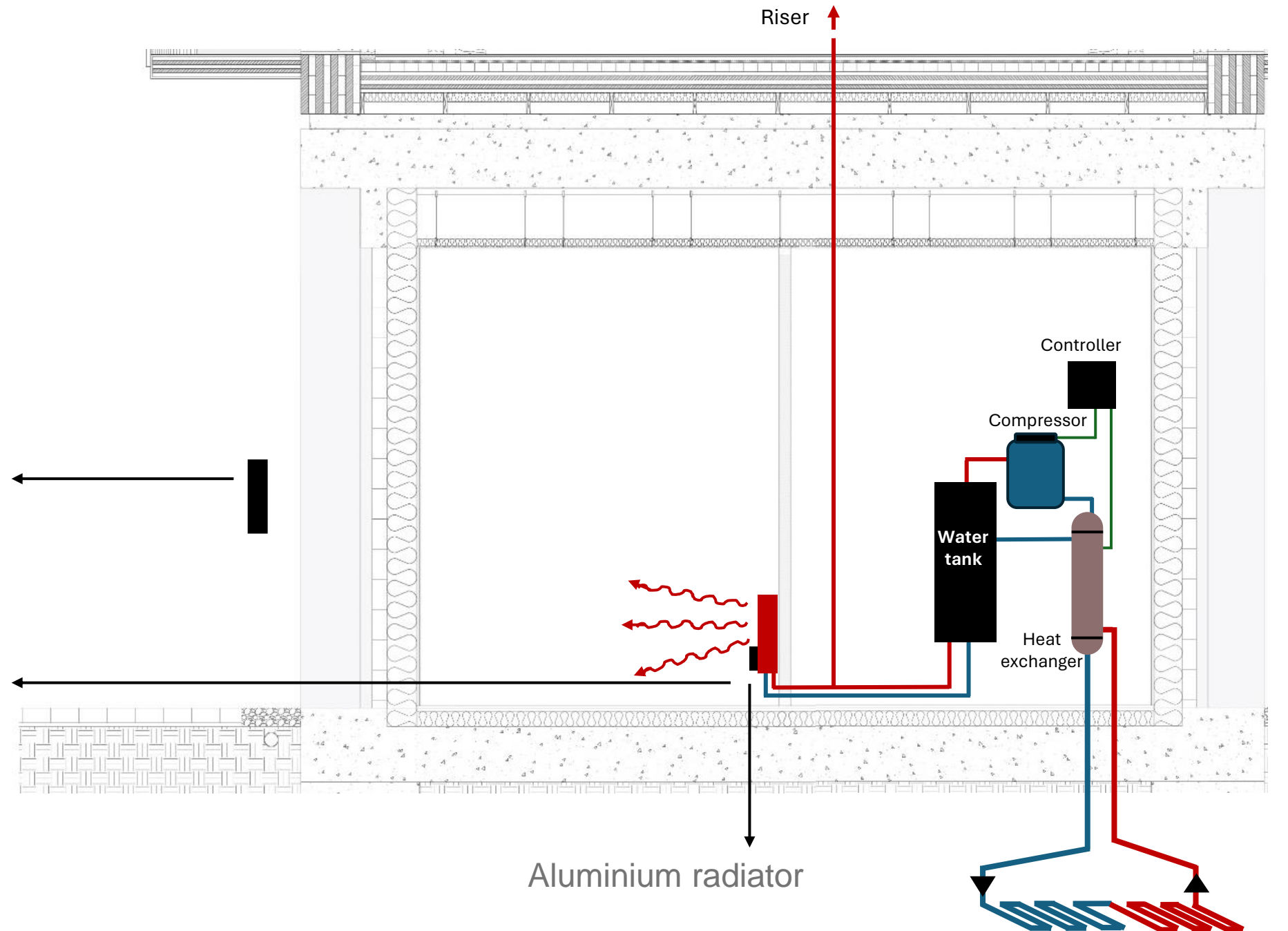


# HEATING REFURBISHED



Thermostat

TRV to control radiator



Aluminium radiators have great thermal conductivity

Uses less water than others

Less energy is needed to heat water

**GSHP loop**

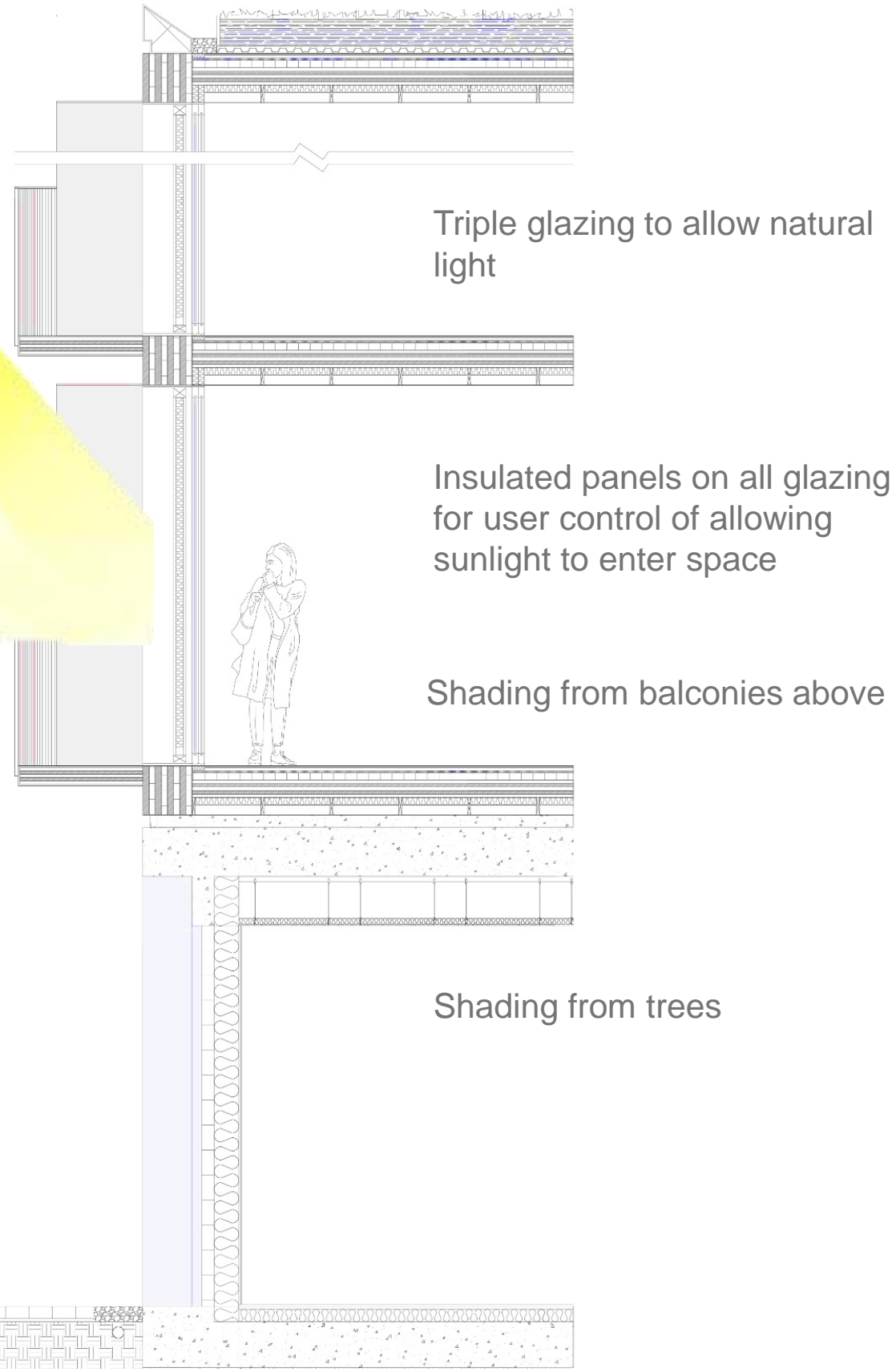
# LIGHTING STRATEGY

## NATURAL

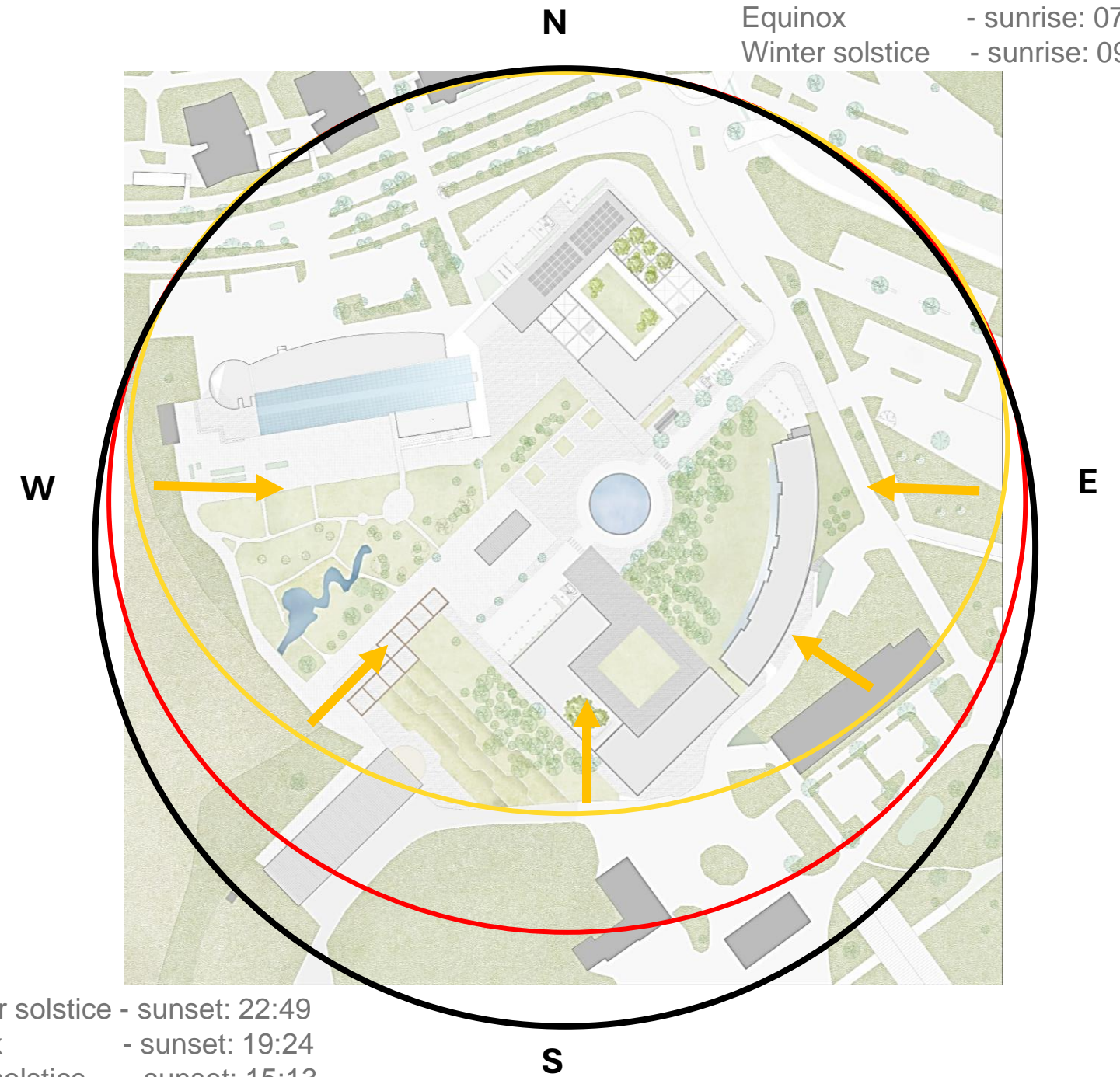
**SUMMER SOLSTICE**  
21<sup>st</sup> June, **53°**

**EQUINOX**  
21<sup>st</sup> March, **39°**

**WINTER EQUINOX**  
21<sup>st</sup> December, **6.4°**



Summer solstice - sunrise: 03:54  
Equinox - sunrise: 07:01  
Winter solstice - sunrise: 09:24



Summer solstice - sunset: 22:49  
Equinox - sunset: 19:24  
Winter solstice - sunset: 15:13



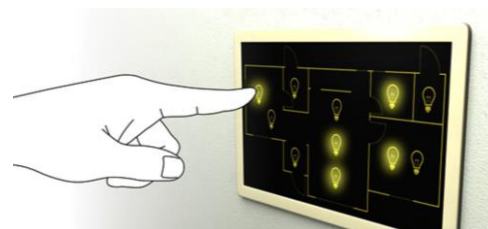
# LIGHTING STRATEGY

## ARTIFICIAL

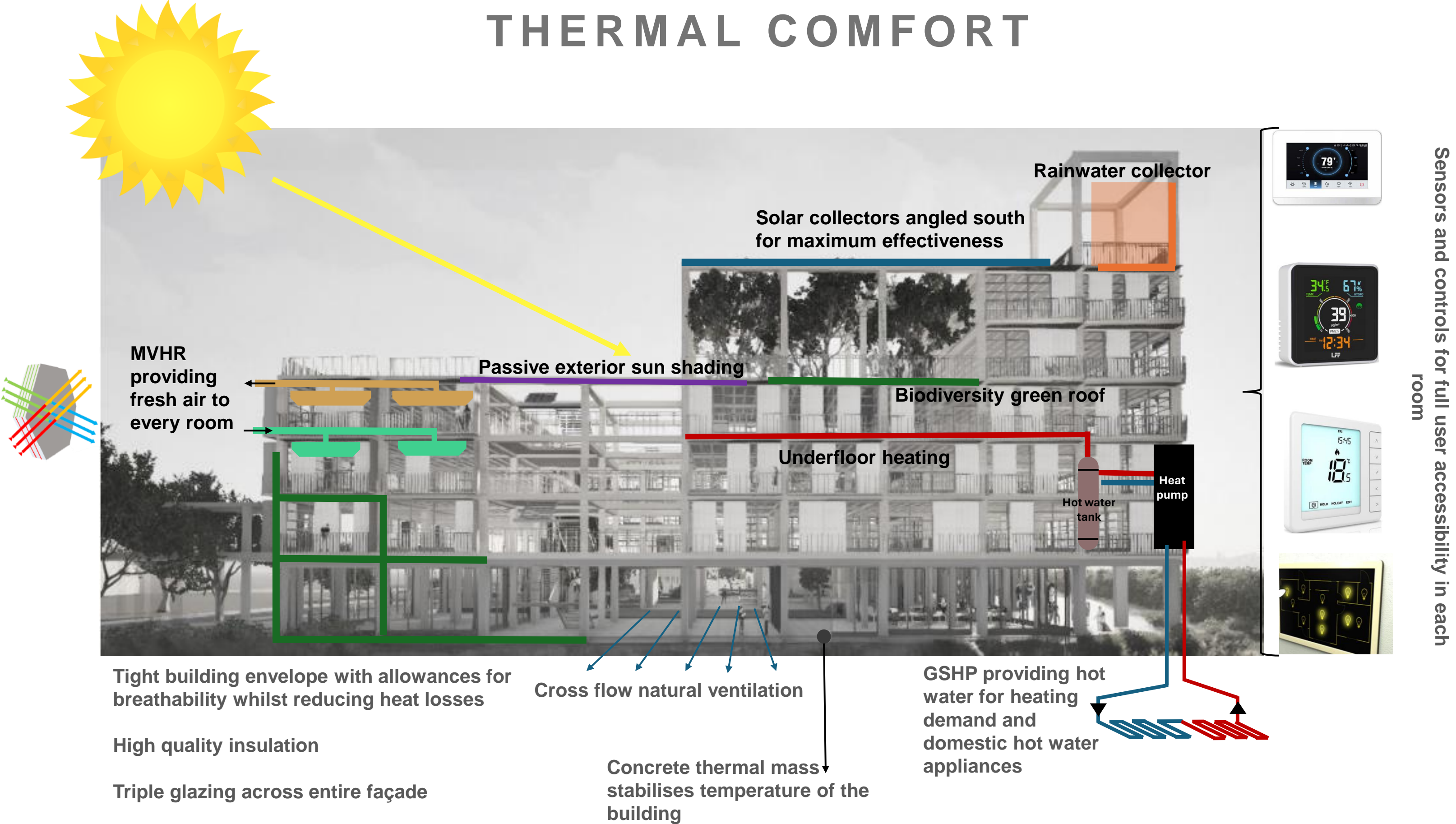


Energy efficient LEDs  
throughout all buildings as a  
second lighting option

Smart controls

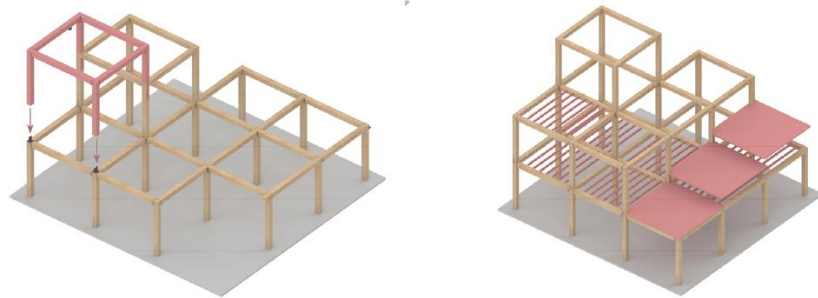
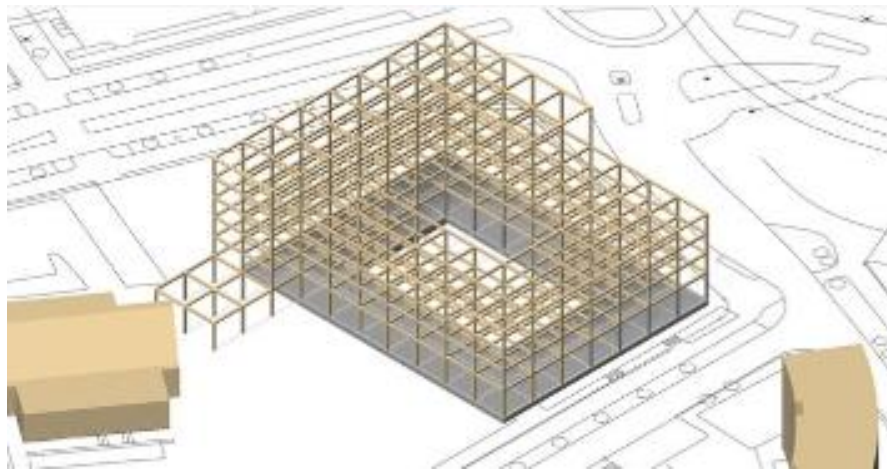


# THERMAL COMFORT



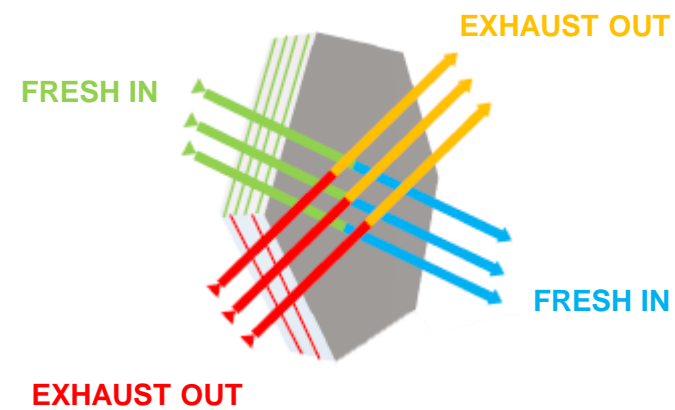
# ADAPTION FOR FUTURE SCENARIOS

## FLEXIBLE TIMBER FRAME



Easy disassembly for growth or reduction of building

## PASSIVHAUS MVHR HEAT RECOVERY UNIT



Boost ventilation for future overheating  
Heat recovery reducing energy demand, cost and CO2

## TIGHT BUILDING ENVELOPE



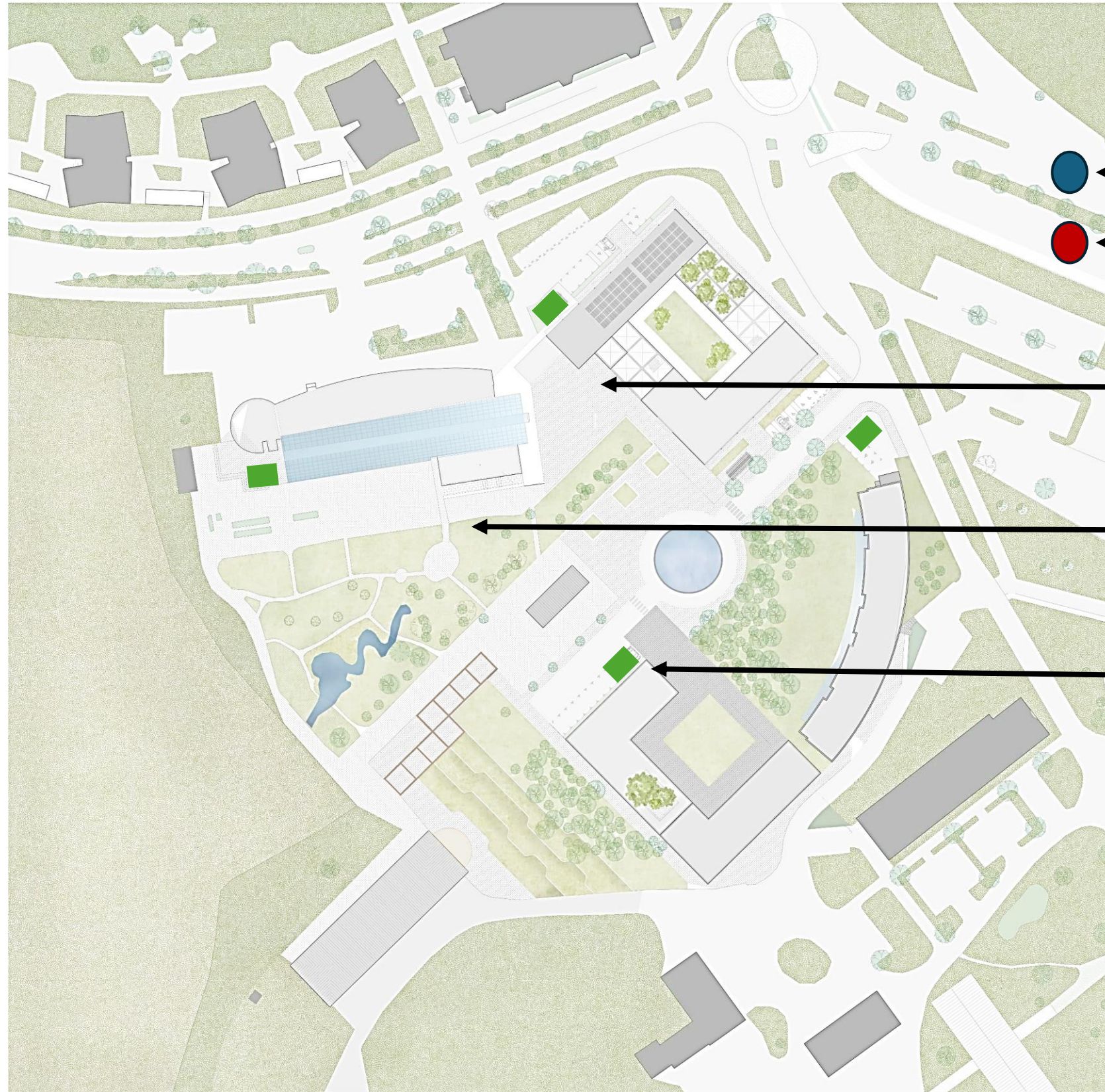
Keeps heat inside building, reducing energy demand, cost and CO2  
Ensures thermal comfort for all occupants

## SOLAR PANELS & BIODIVERSITY



Extra solar panels on pavilion roof  
Biodiverse pavilion roof  
Space for greenhouses around site to grow locally

# SUSTAINABILITY



## Transport links

Bus stop

Tram stop

Encourage walking to campus

Pedestrian walkways everywhere

Encourage public transport

Limited car park spaces

Encourage biking to campus

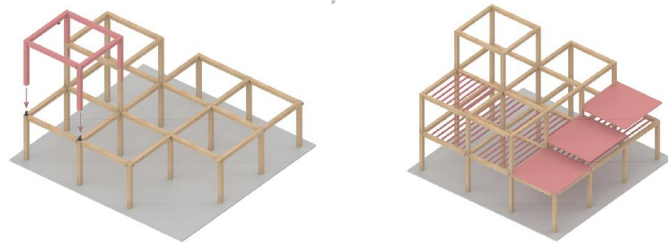


Green bike racks

# ROUTE TO NET ZERO



## DECONSTRUCTION OF TIMBER FRAME



## RECYCLE BUILDING MATERIALS

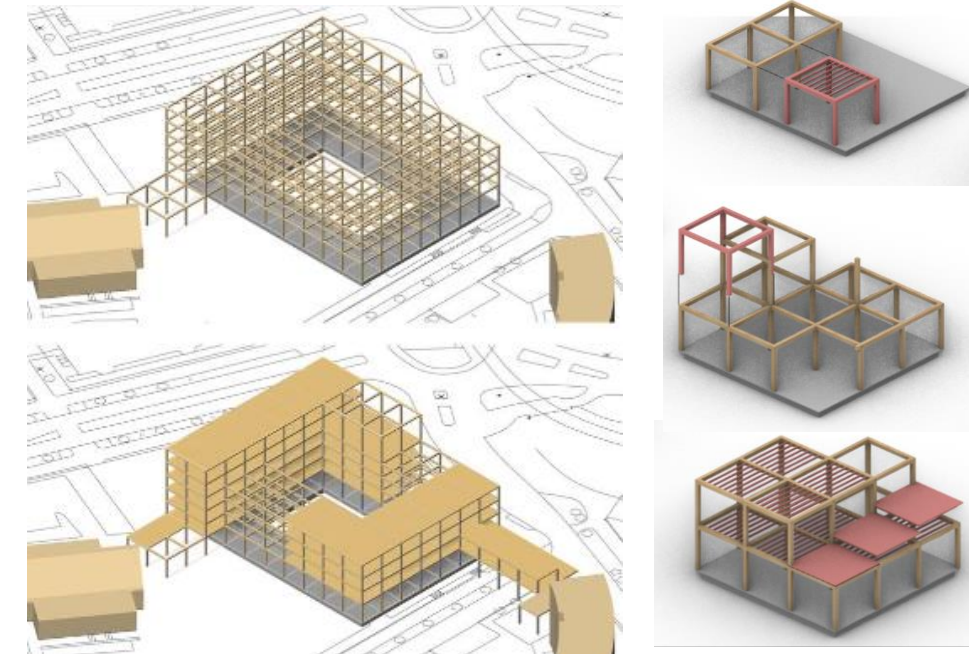


## EXTRACTION



FSC certified forests  
Re-use existing concrete  
Low embodied carbon materials

## PRE-FABRICATION

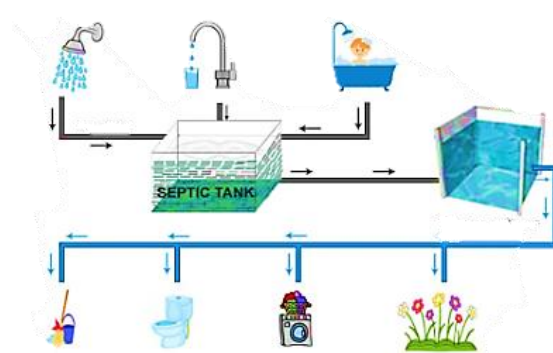


## IN USE

### Triple glazing



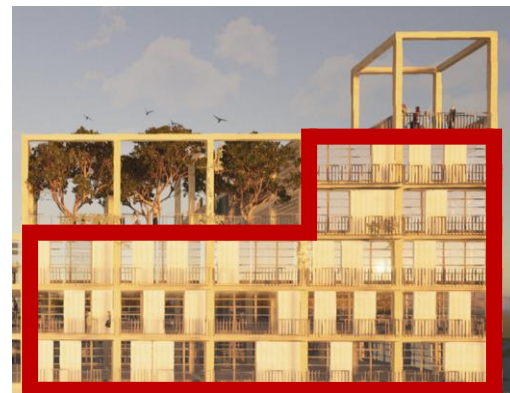
### Greywater recycling



### Rainwater harvesting



### Passivhaus thermal envelope



## CONSTRUCTION



## MATERIAL TRANSPORTATION



**CO<sub>2</sub>** Total carbon emissions: **51.06 kgCO<sub>2</sub>/m<sup>2</sup>/yr**


**€** Total carbon cost: **€ 1,433,784**

Cradle to grave (A1-A4, B4-B5, C1-C4)	kg CO <sub>2</sub> e/m <sup>2</sup>
(< 440) <b>A</b>	<b>351</b>
(440-540) <b>B</b>	
(540-640) <b>C</b>	
(640-740) <b>D</b>	
(740-840) <b>E</b>	
(840-940) <b>F</b>	
(> 940) <b>G</b>	

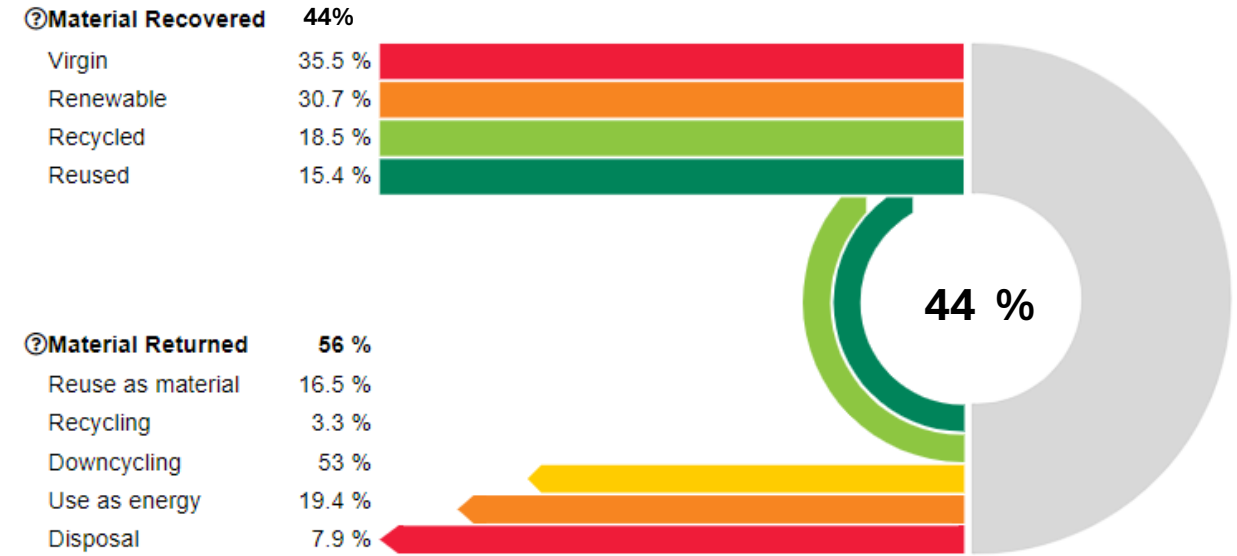
Total energy demand:  
**85,200kWh/yr**

Total renewable energy production:  
**43,000kWh/yr**

Remainder energy:  
**GSHP supply**

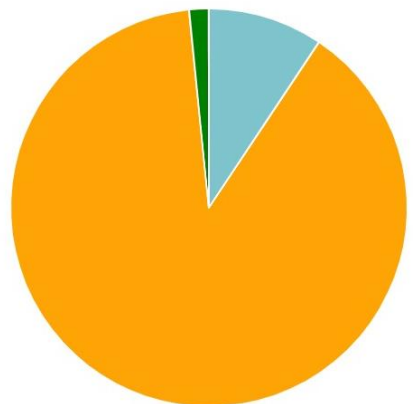


## NEW building circularity



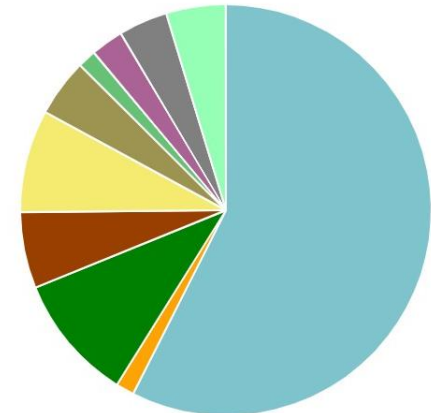
## Total tons - Life-cycle stages

- A1-A3 Earth masses - 9.4%
- A1-A3 Materials - 89.0%
- B4-B5 Material replacement - 1.6%



## Global warming kg CO<sub>2</sub>e - Classifications

- 1.1 Foundations (substructure) - 57.5%
- 1.2.1 Frame (beams, columns and slabs) - 1.4%
- 1.2.3 External walls - 10.0%
- 1.3.2 Internal walls, partitions and doors - 6.0%
- 1.5 Roof - 8.1%
- 2.1.3 Ceilings - 4.5%
- 2.4.1 Air handling units - 1.5%
- 3. External works - 2.6%
- Electricity use - 3.8%
- Other classifications - 4.7%



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