Flexible | Vrieheide

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Building construction teacher | Engbert van der Zaag

TU Delft Delft University of Technology | IBA Parkstad

Presentation

Content

Introduction

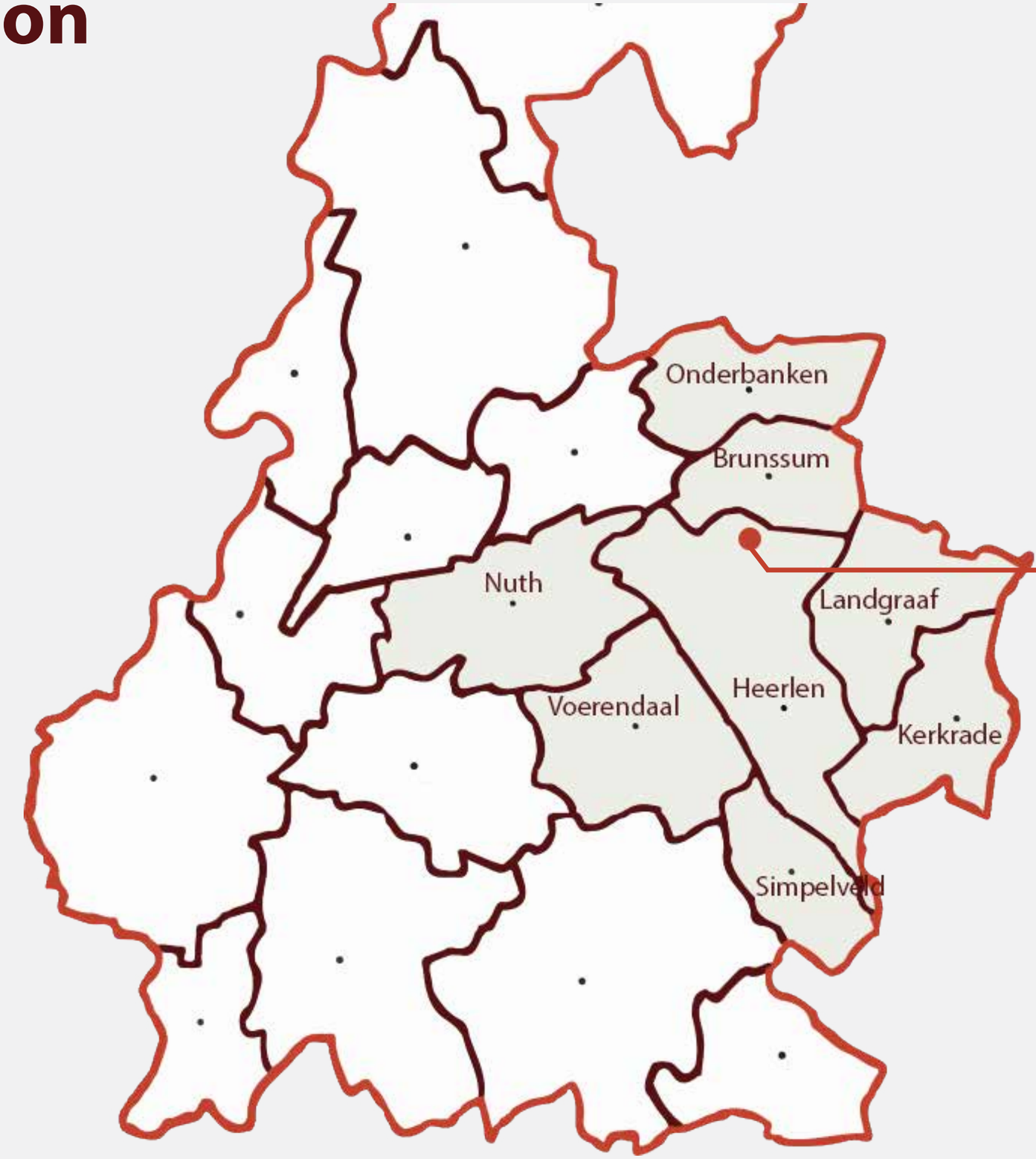
Fascination

Introduction

Location

Introduction

Location



Vrieheide, Heerlen

Introduction

Location

Post-war neighbourhood with prefab buildings

Introduction

Location

N

Neighbourhood of over 800 family houses to solve the housing shortage.

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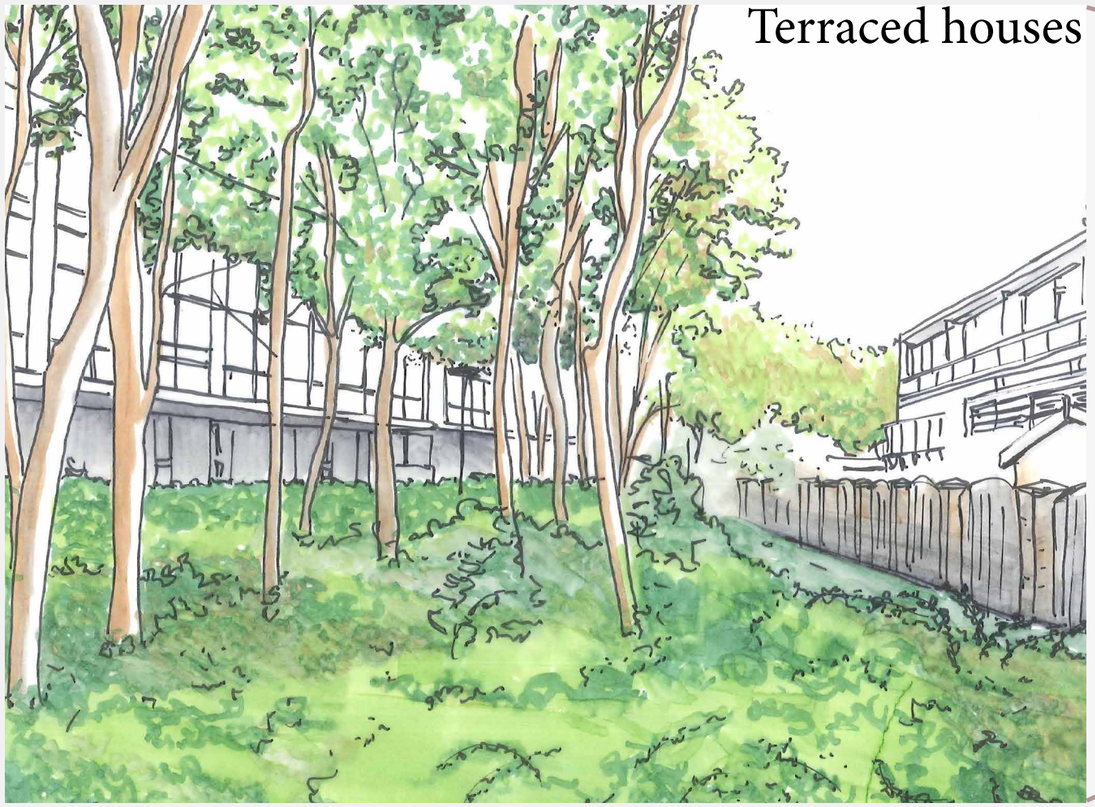
Introduction
Neighbourhood



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Introduction
Neighbourhood


Gallery flats

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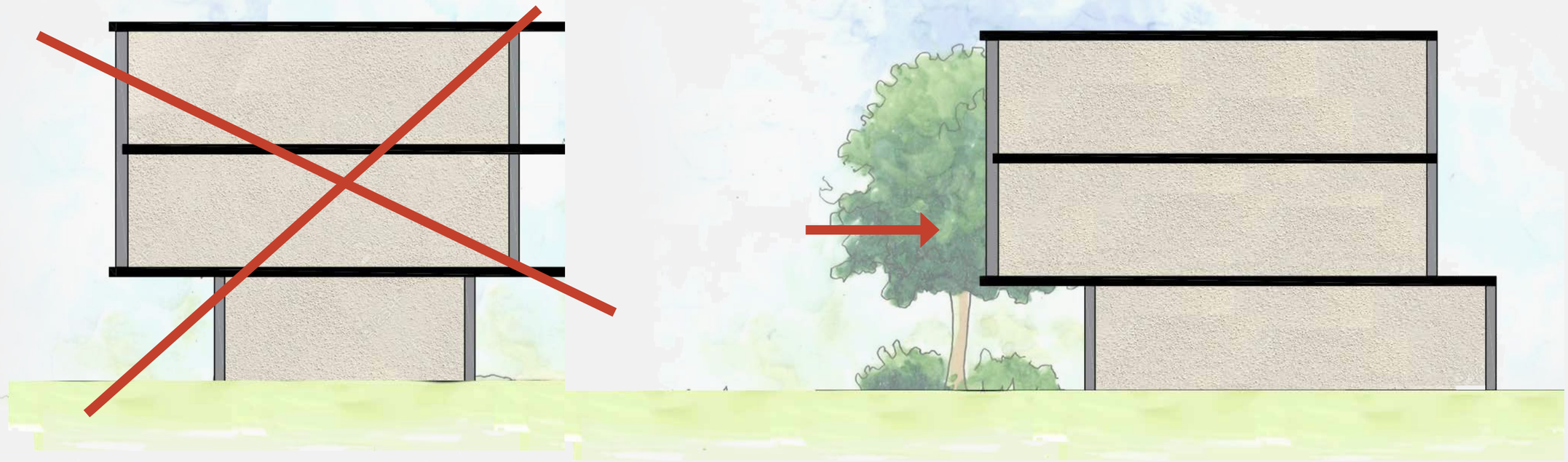
Problem statements

Problem statement 1

Vacant homes

Problem statement 1

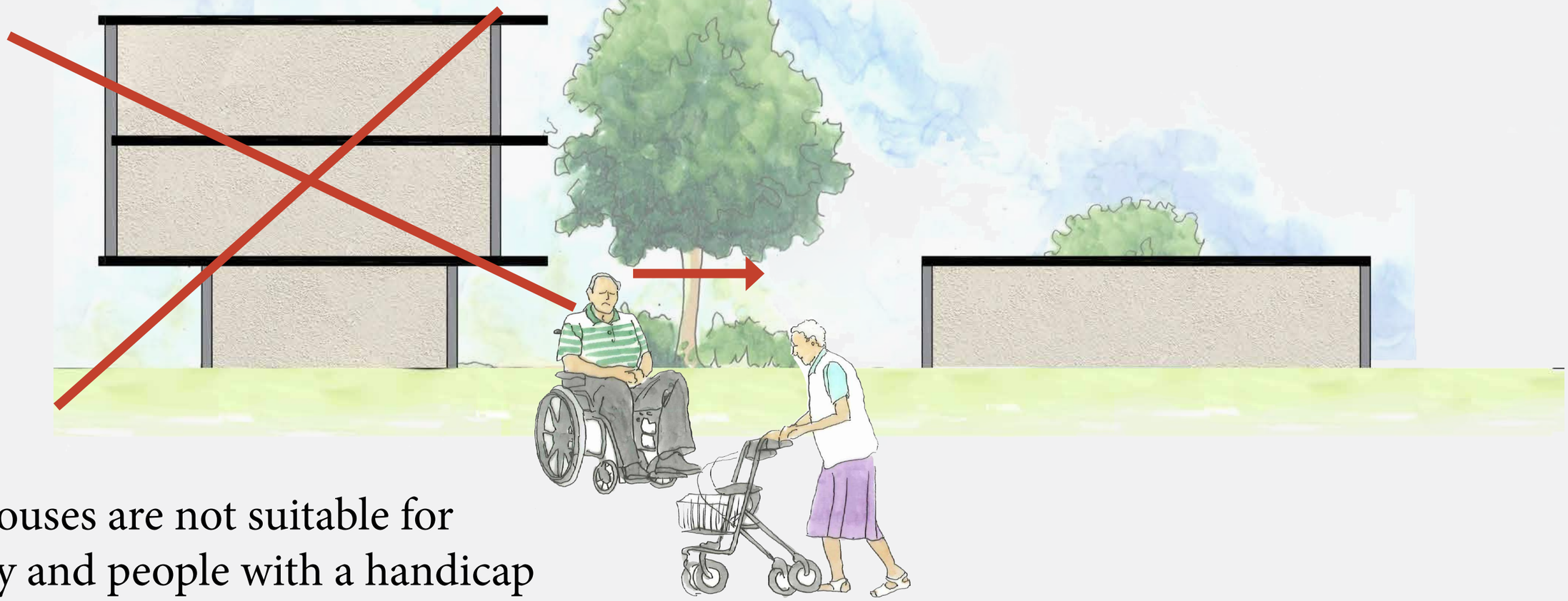
Families move



The houses in Vrieheide are not big enough for families

Problem statement 1

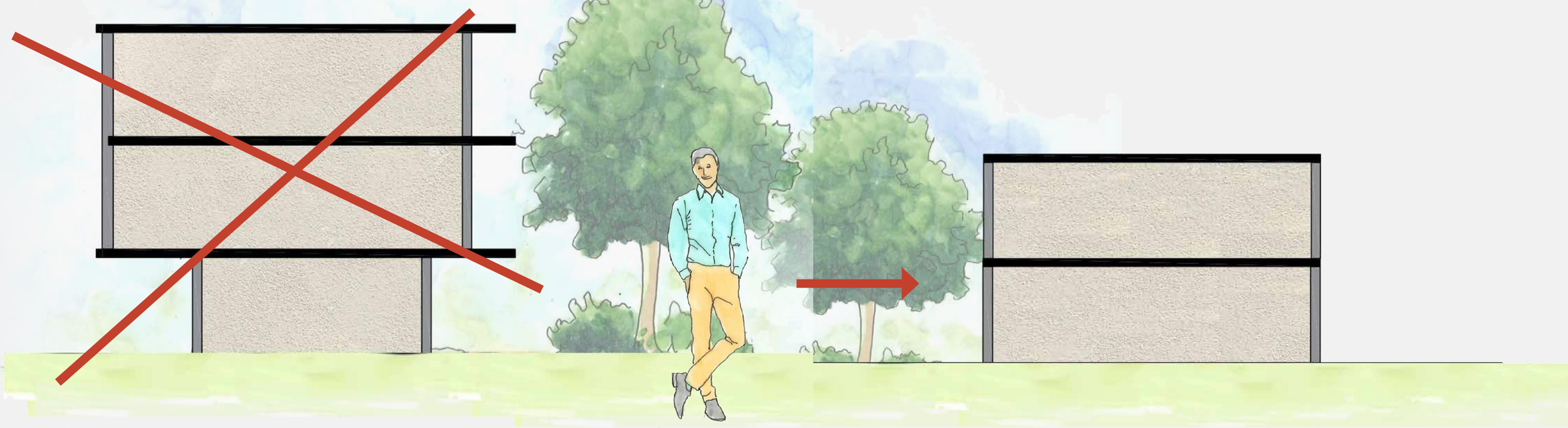
Elderly move



The houses are not suitable for
elderly and people with a handicap

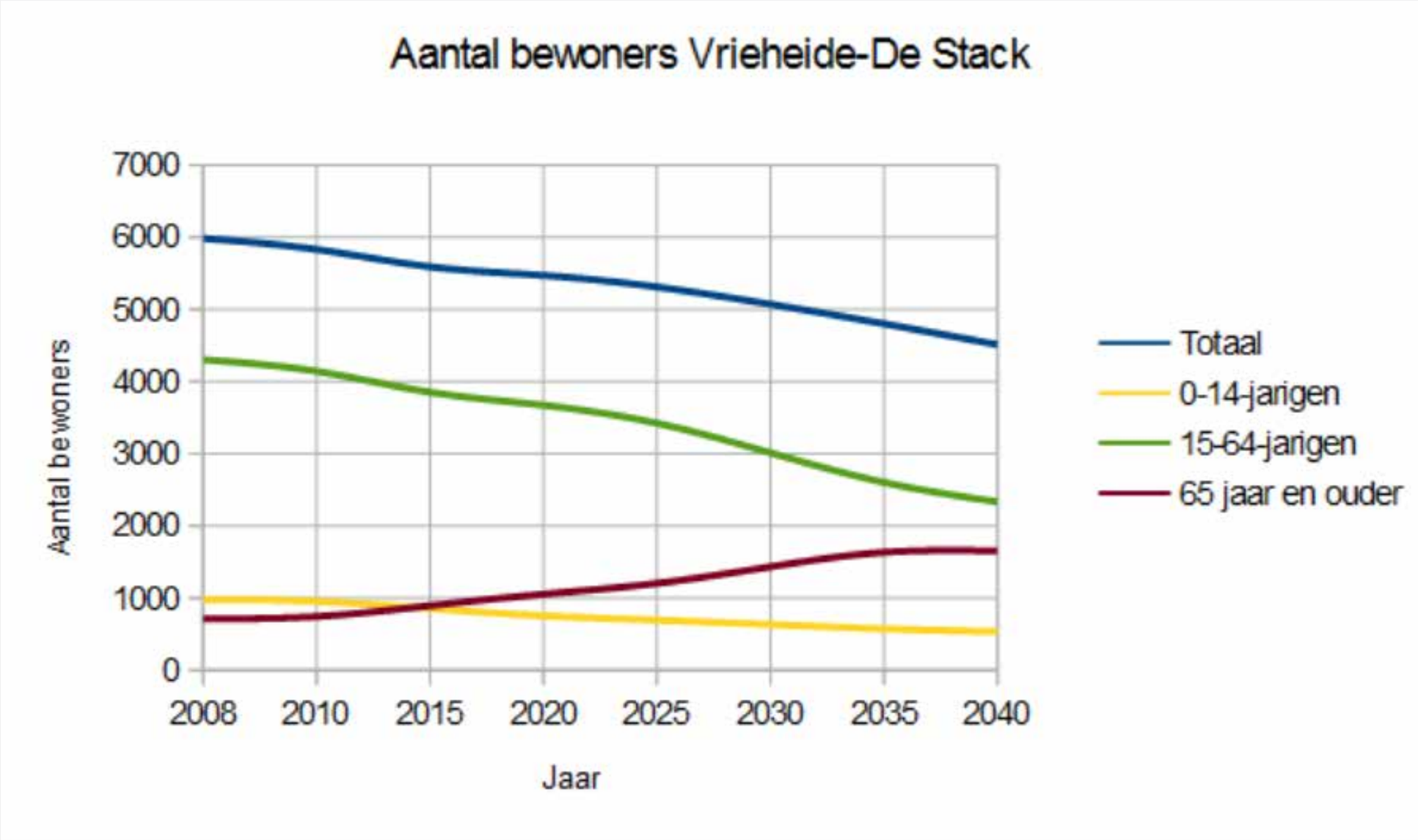
Problem statement 1

Young people move

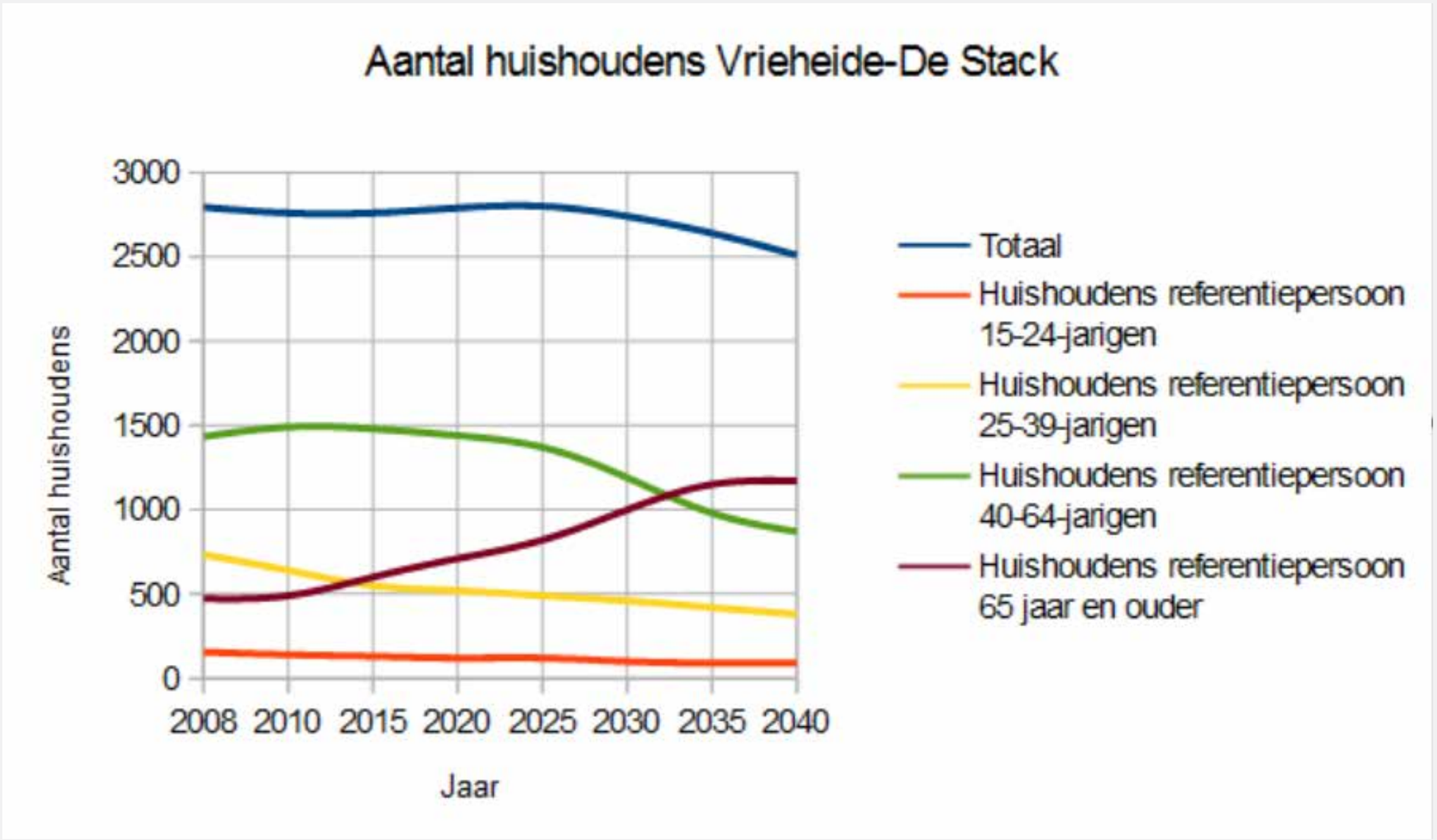


The houses are to big for starters

Problem statement 1



Problem statement 1



Problem statement 1

Young people move

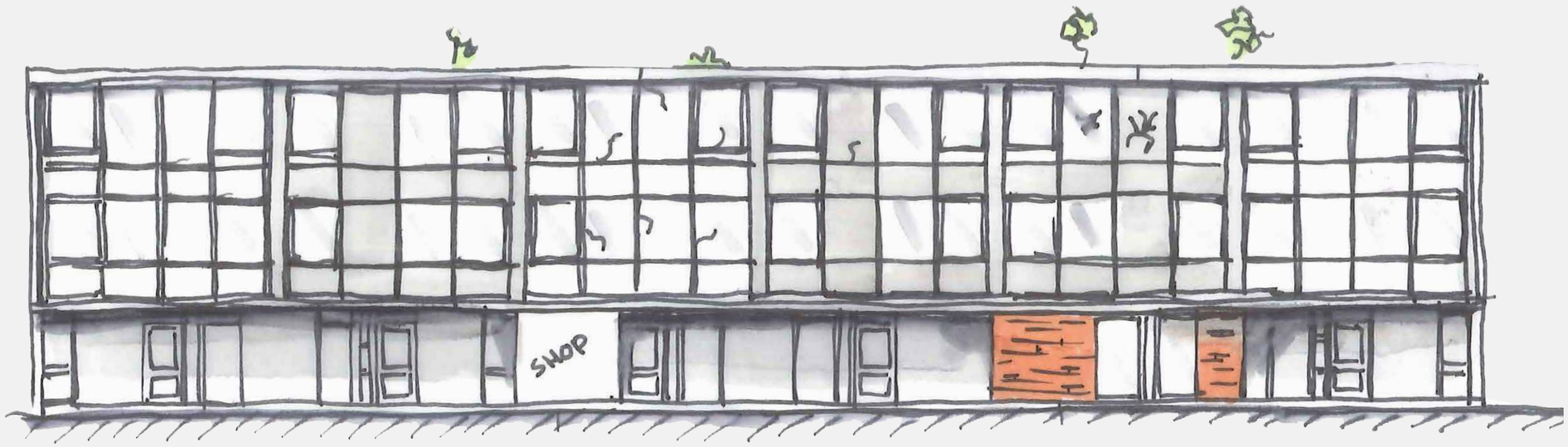
And many starters cannot find work and move to other cities

Problem statement 1

The housings stock of Vrieheide does not meet the requirements of the residents.

Problem statement 2

Quality existing buildings

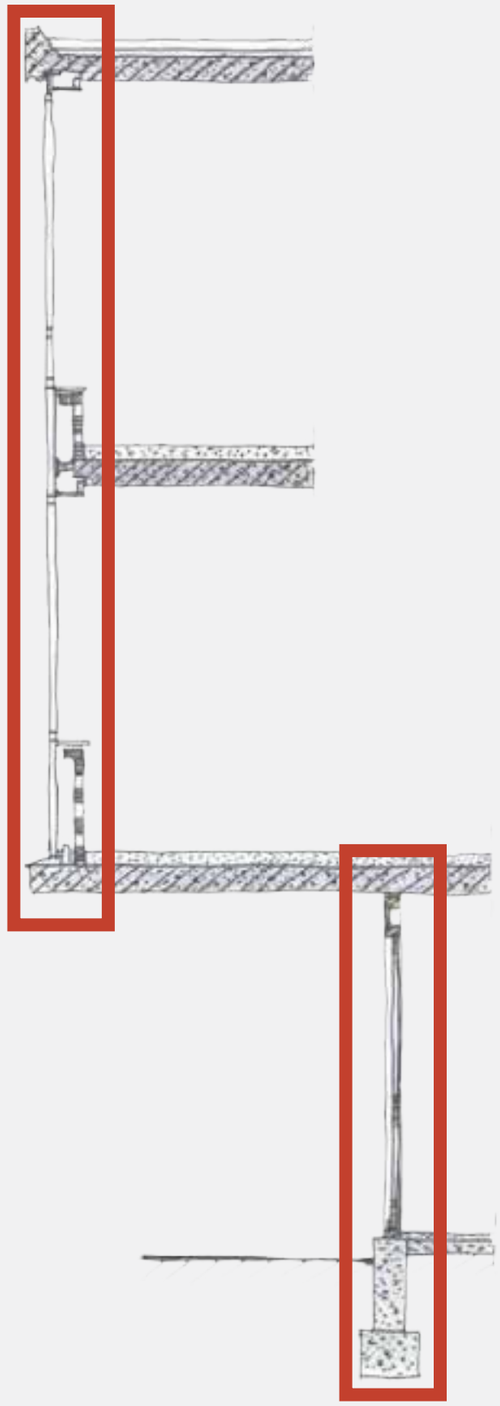


Problem statement 2

Quality of the façade

N

No insulation



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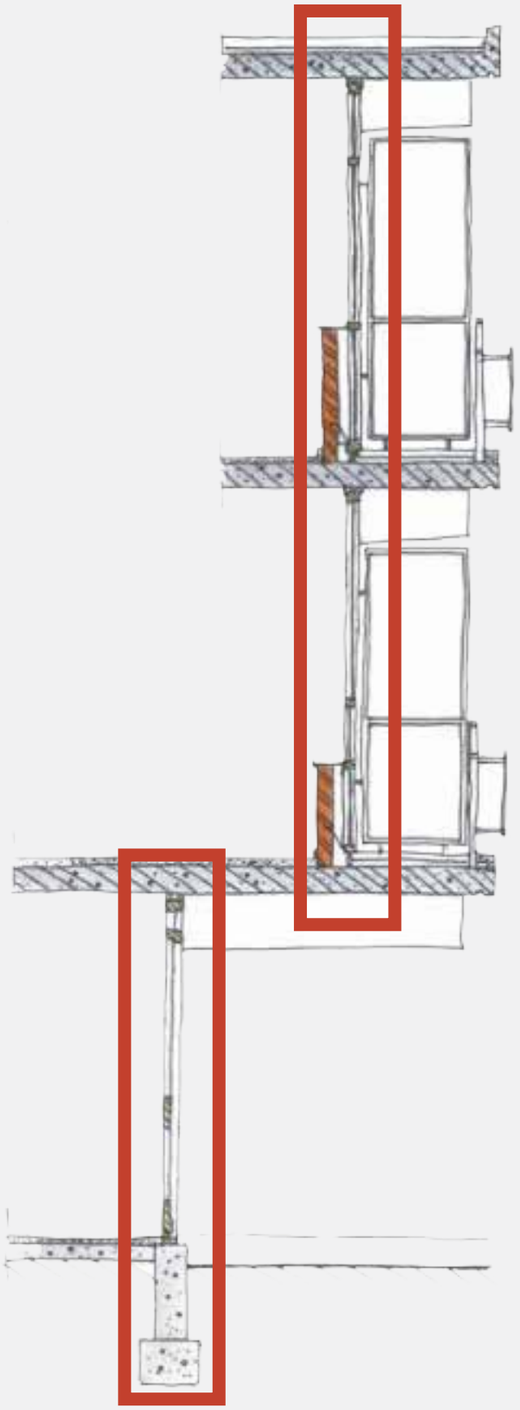
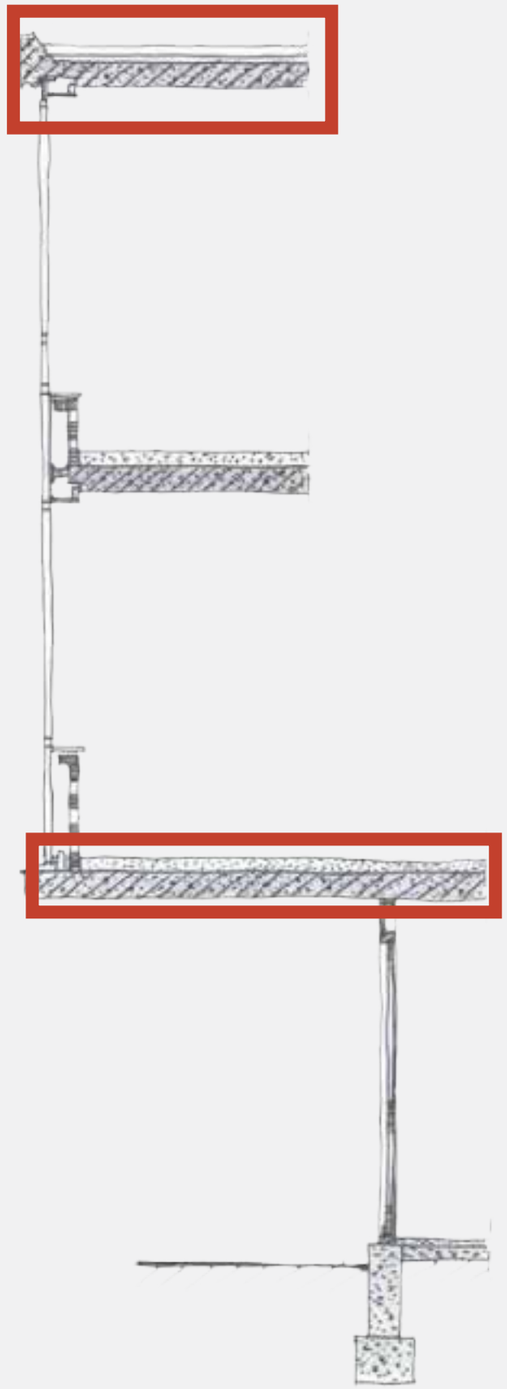


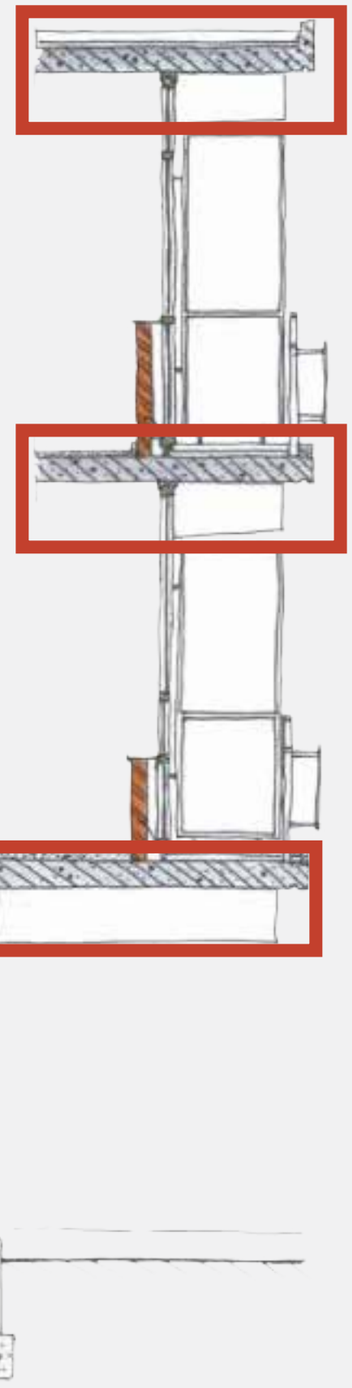
Problem statement 2

Quality of the façade

N

Thermal bridges





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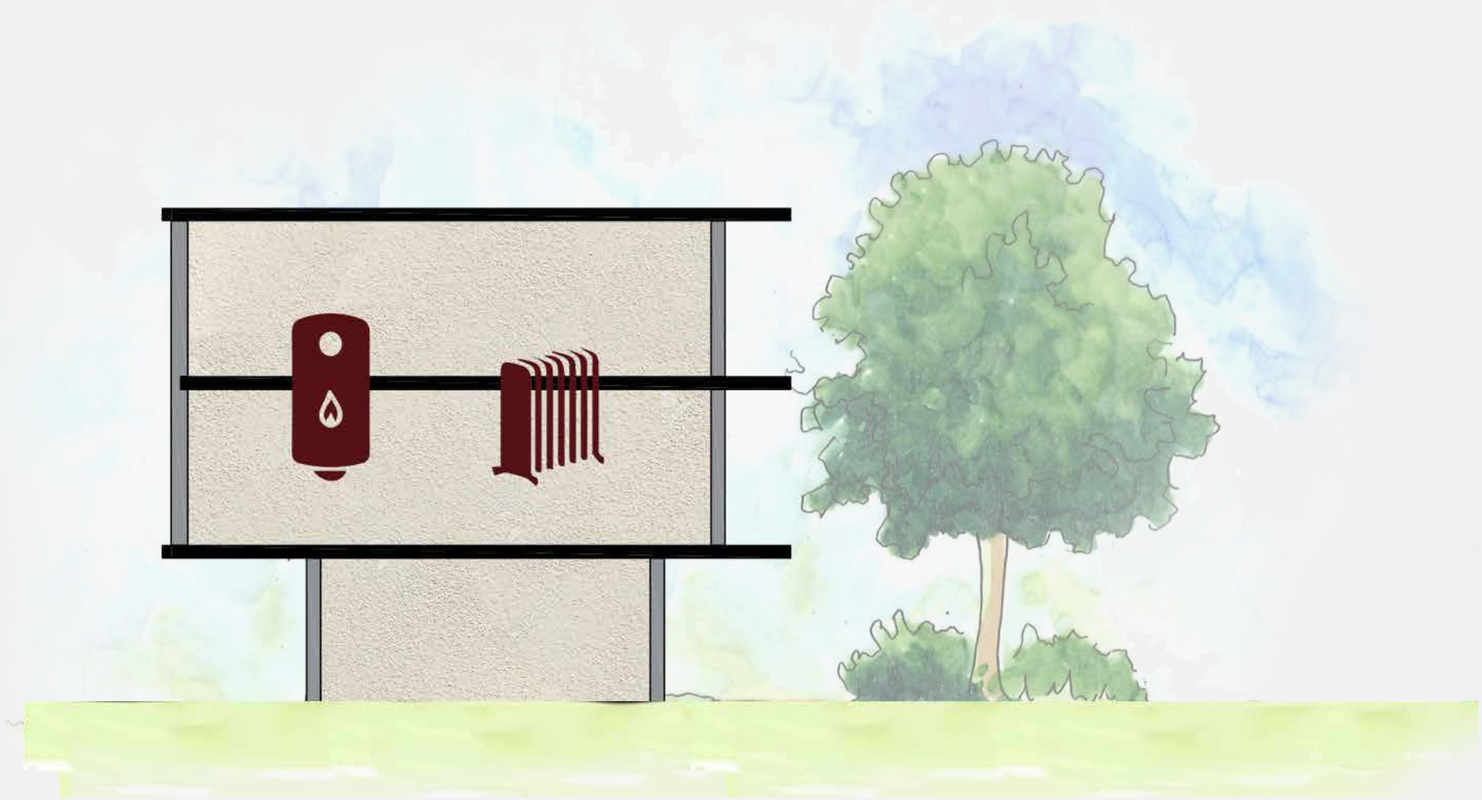
Uninsulated balconies

Problem statement 2

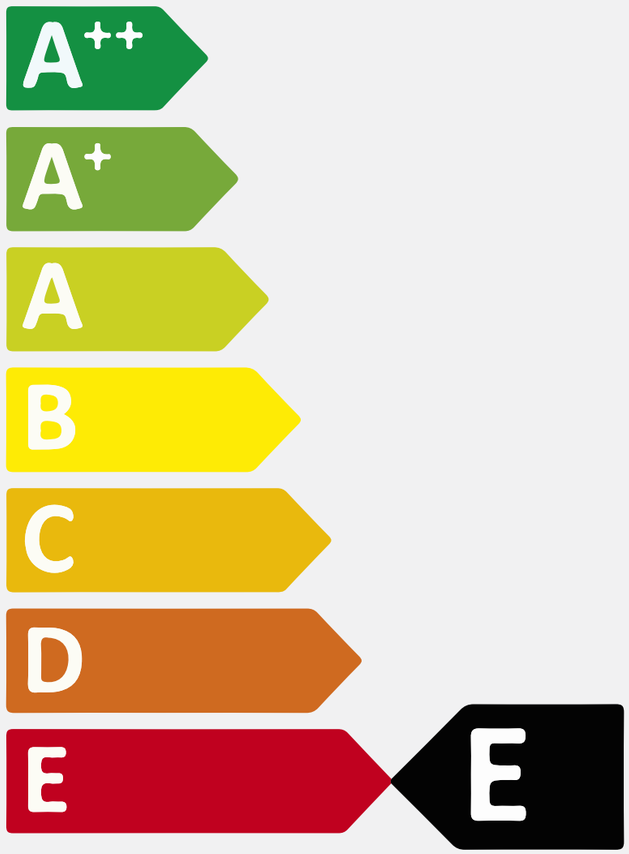
Climate systems



Outdated climate systems

Problem statement 2

Energy costs



Results in high energy costs

Problem statement 2

N

The housing stock of Vrieheide does not meet the current requirements of the buildings physics.

Questions

Design question 1

"How can the current building stock be adapted to the needs of the residents?"

Questions

Design question 2

"How can modular built post-war residential buildings be made energy- and CO2- neutral with the use of renewable materials and be made into houses for life?"

Questions

Research Question

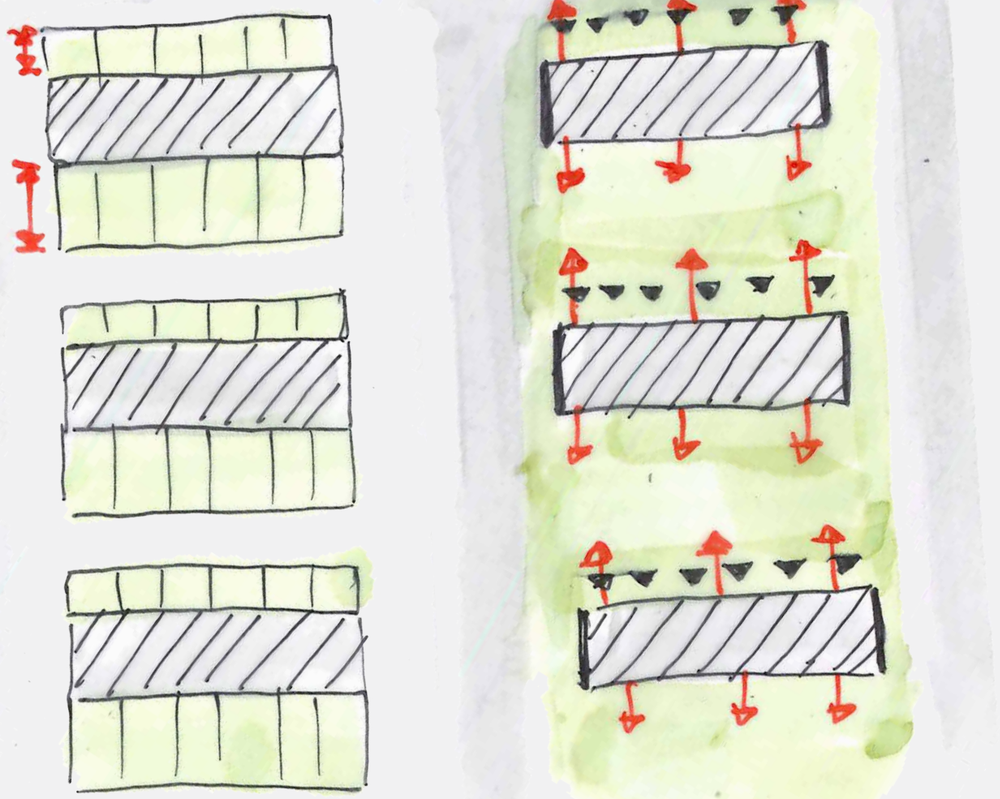
"What is the best way to build renewable, prefab, wooden façade elements for post-war residential buildings in the Netherlands?"

Project

Neighbourhood

Project Neighbourhood

Current situation



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Project Neighbourhood

Current situation

Height differences

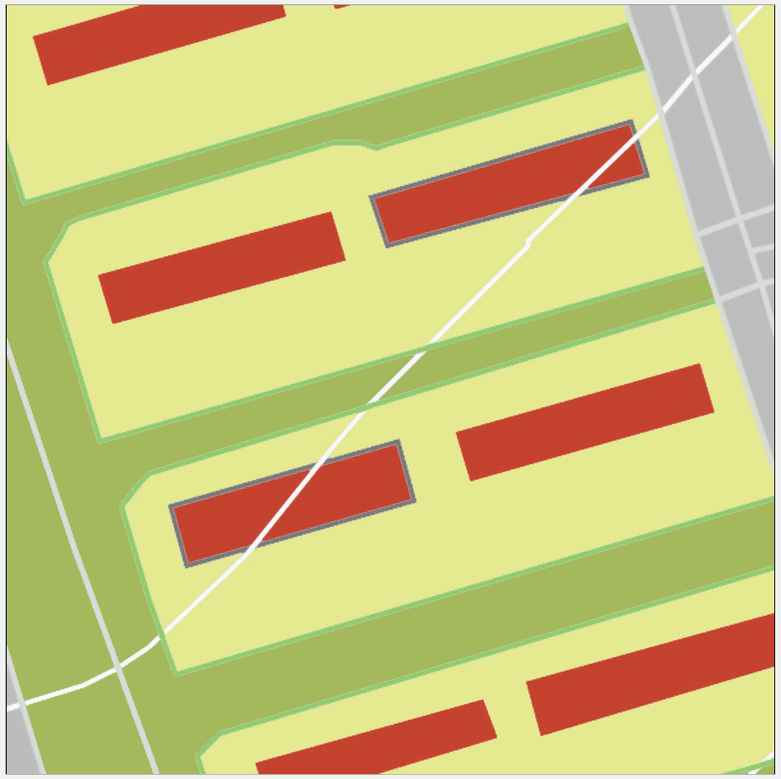
Project Neighbourhood

Current situation

Monotony building blocks

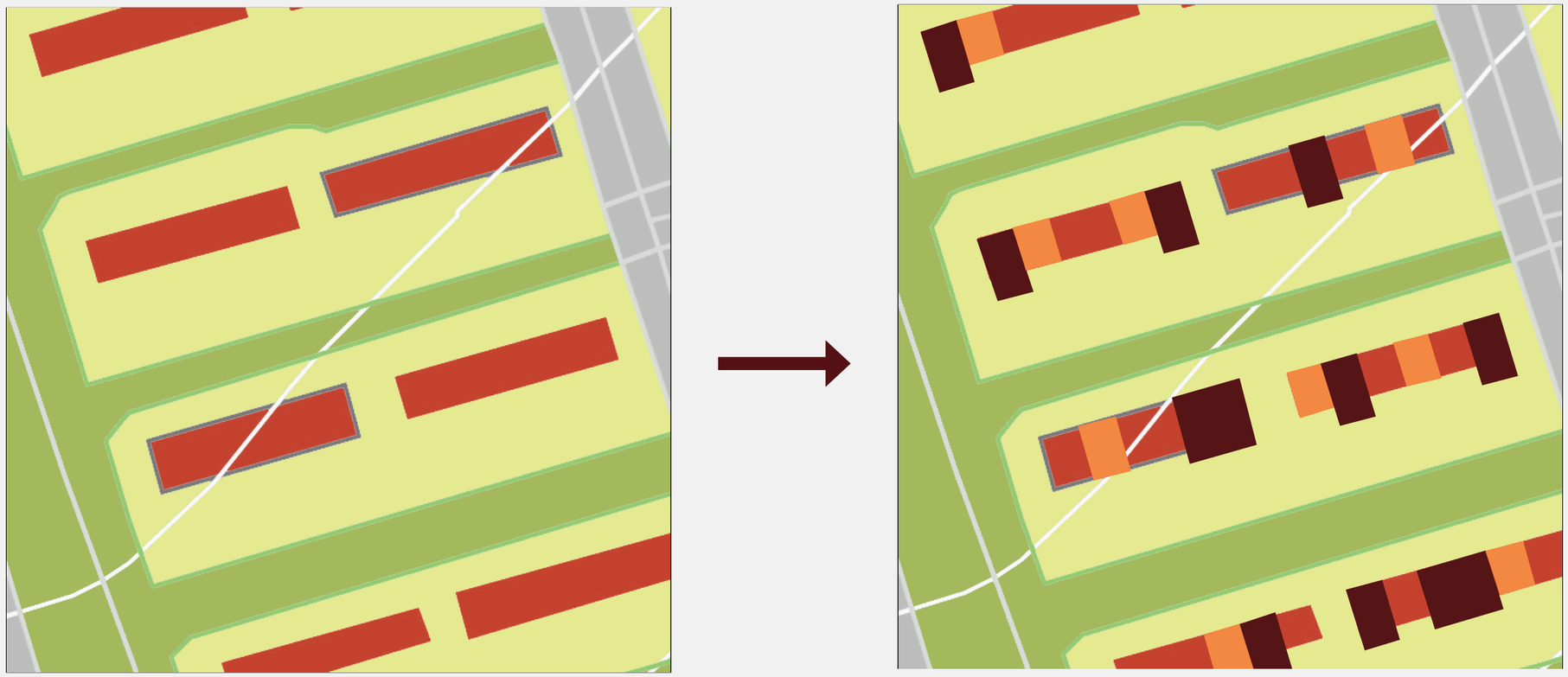
Project Neighbourhood

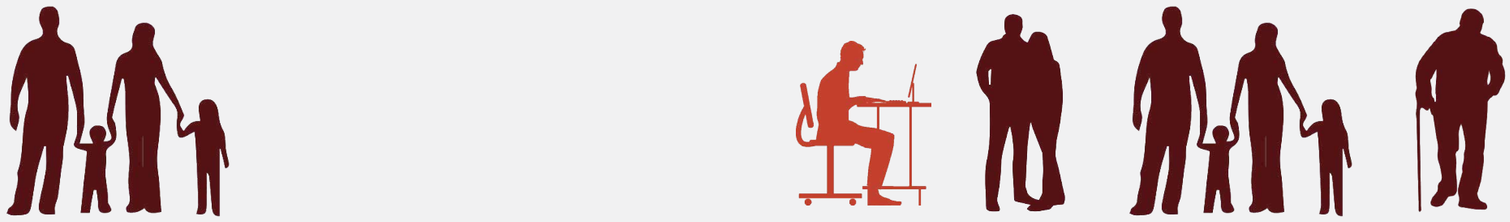
Current situation



Monotony in function

Project
Neighbourhood





Buildings

Project

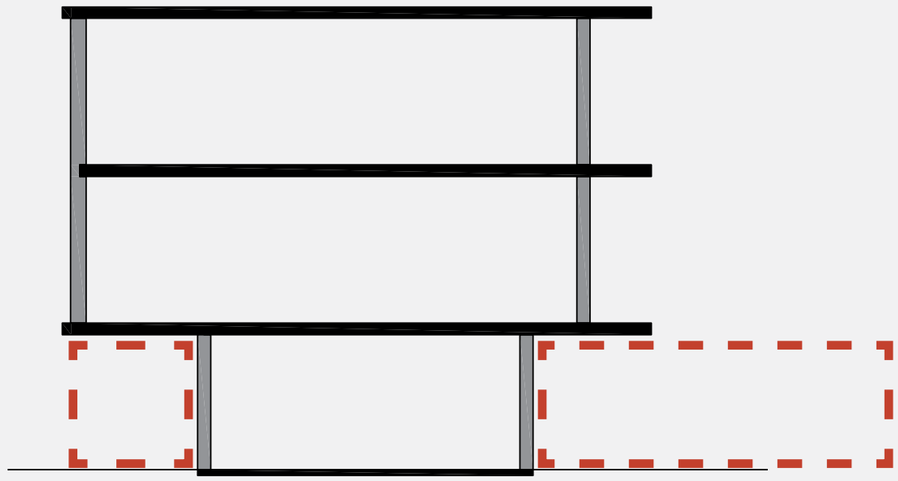
Current situation

Project

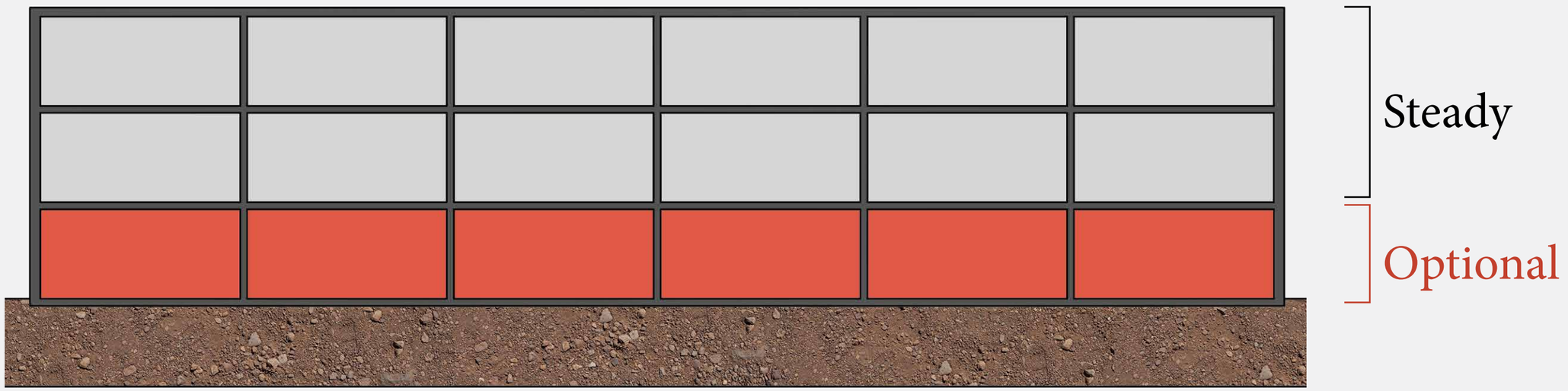
Current situation

Project

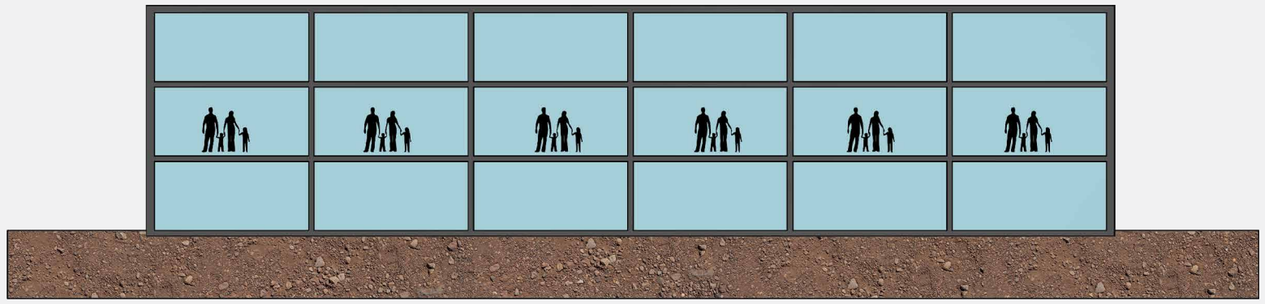
Current situation



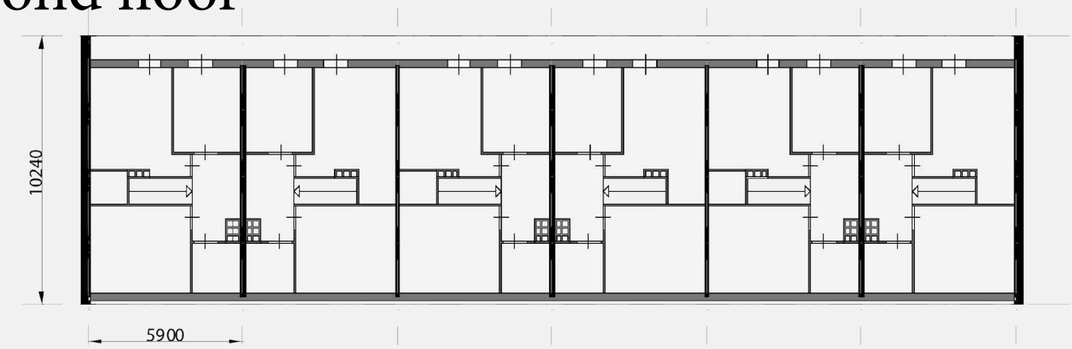
Possible places for extensions in original plan



Project
Current situation

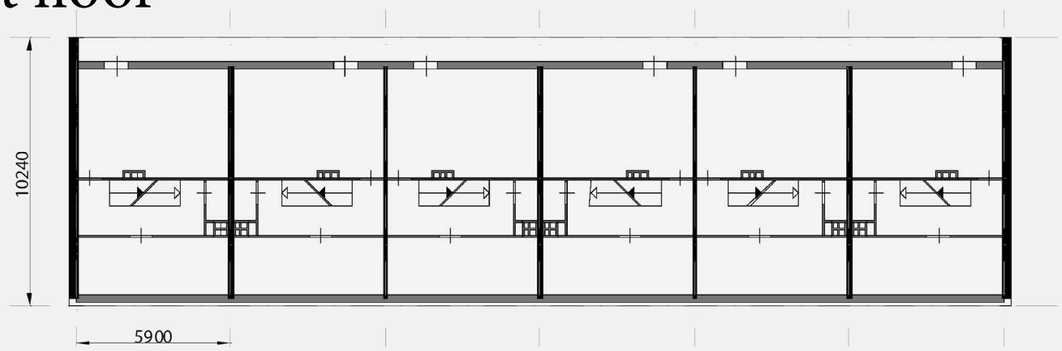


Second floor



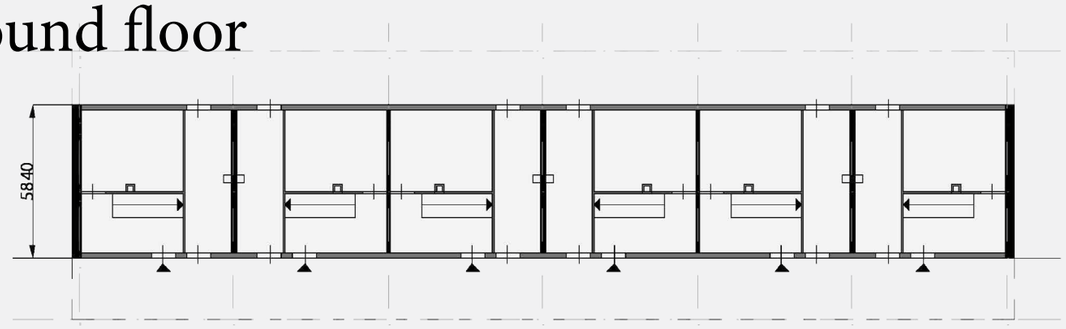
Bedrooms and bathroom

First floor



Living room and kitchen

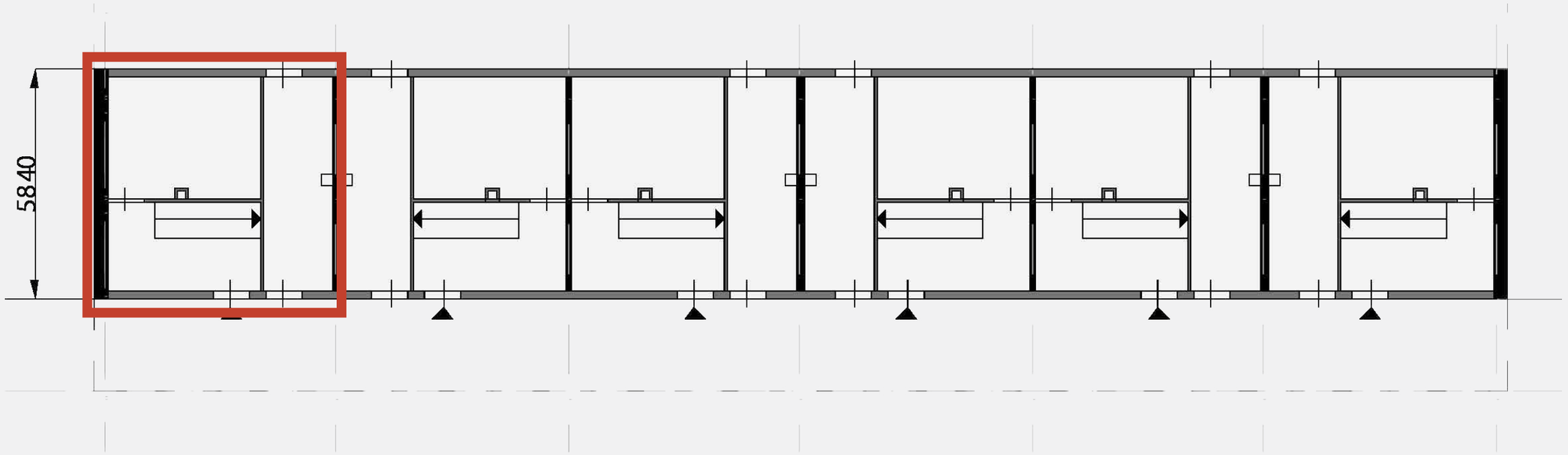
Ground floor



Storage space

Project

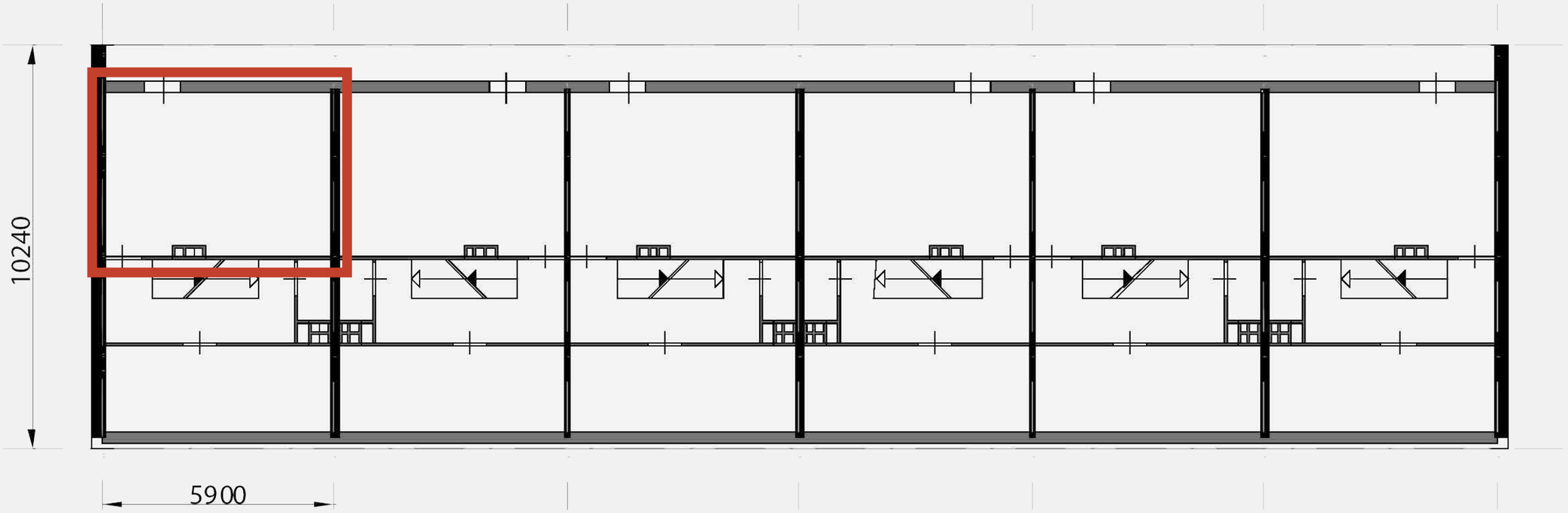
Current situation



Only space for storage

Project

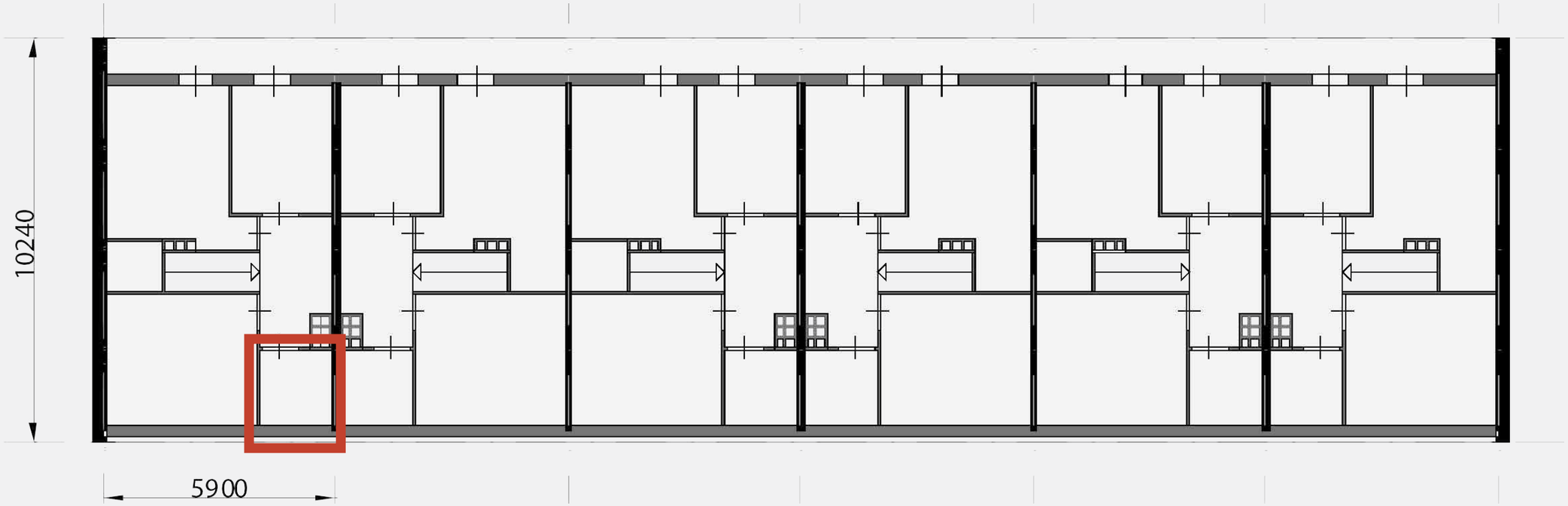
Current situation



Small living room

Project

Current situation



Small bathroom

Project

Current situation

Changes that residents did to make their homes bigger

Project

Suitable housing for the elderly?

Small groundfloor

Project

Suitable housing for the elderly?

Stairs

Project

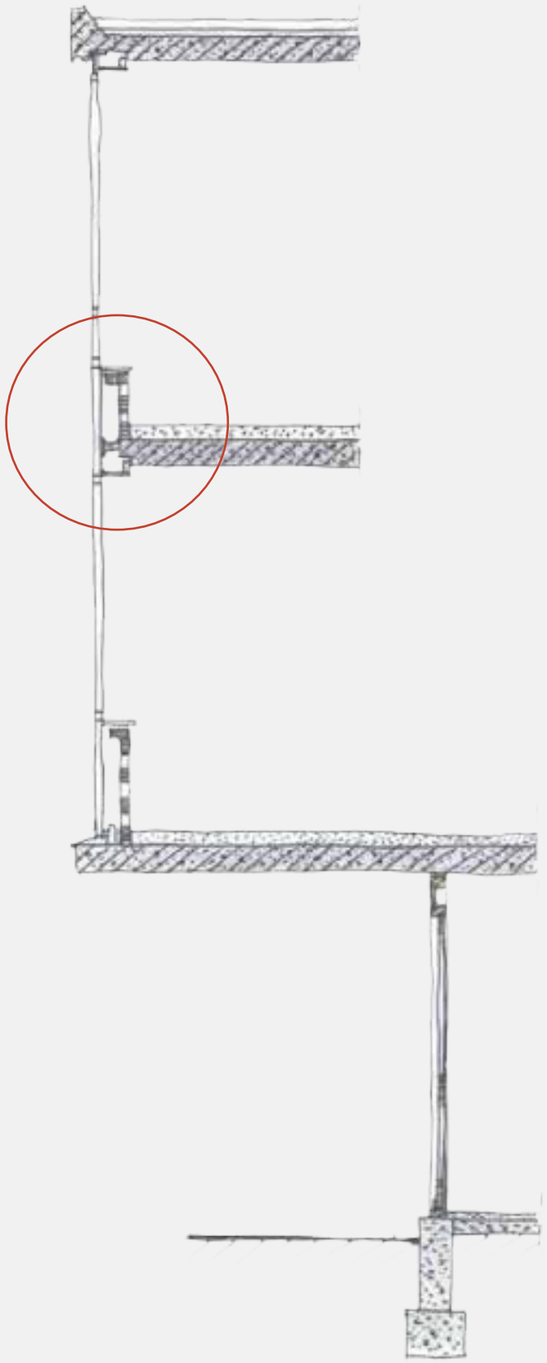
Suitable housing for the elderly?

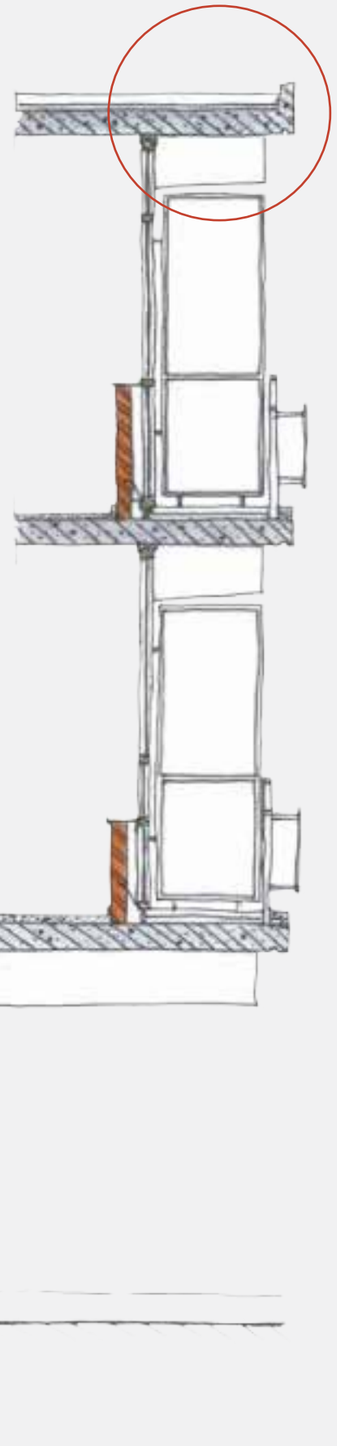
Kitchen and toilet on first floor

Project

Quality of the façade

N





S

Project

Only construction of good quality

Users

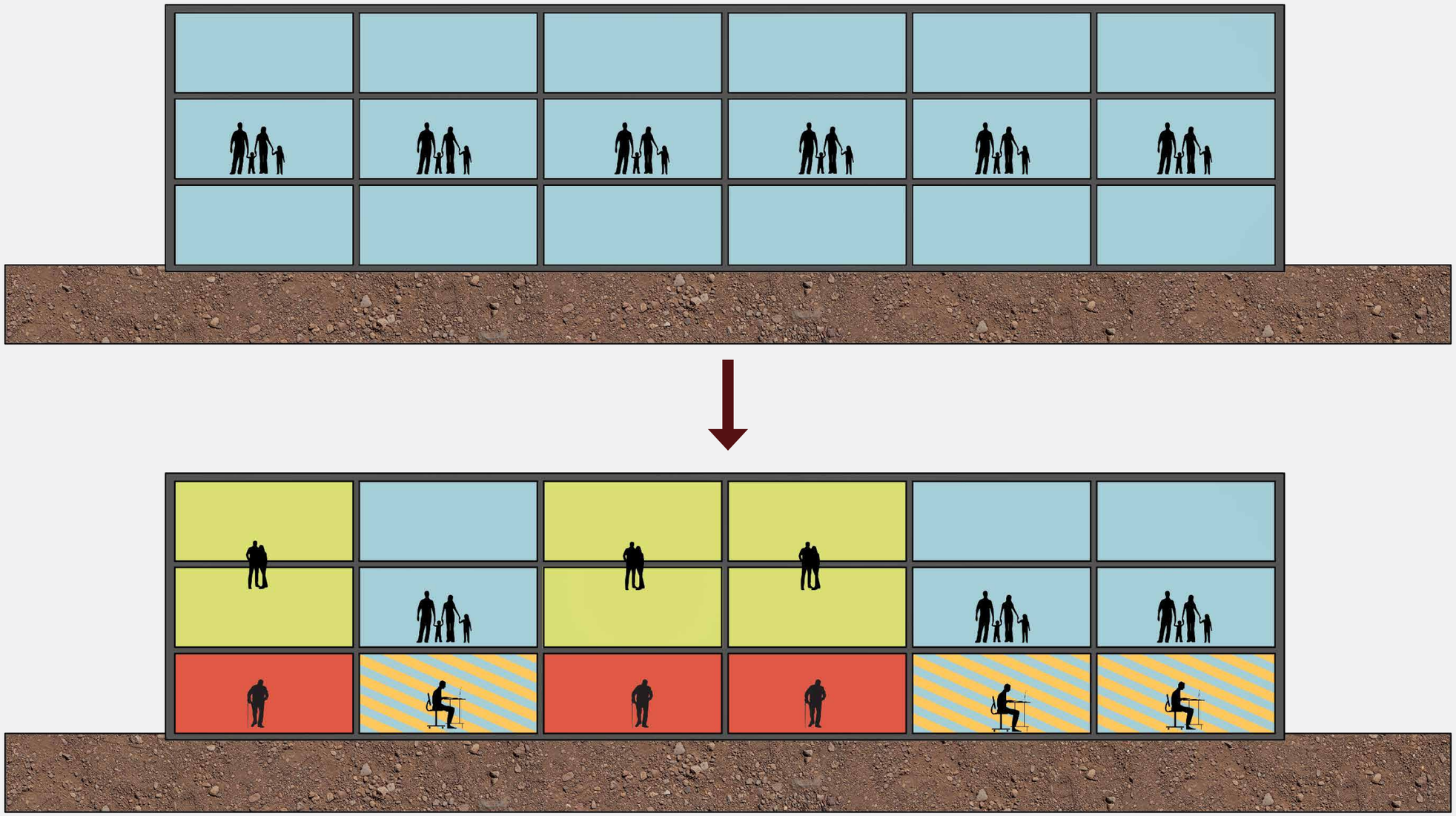
Project

User requirements

Users	Starters	Families	Elderly (55+)
Type of home	Ground bound or flat with elevator	Ground bound family homes	Flat with elevator, one storey
Rooms (living- + bed rooms)	3 or 4	4 or 5	2 or 3
Area	50 m2	120 m2	75-100 m2
Size of living room	20 m2	>30 m2	25 m2
Balcony	4m2		10 m2
Garden (depth)	5m	14m	20m2
Extra wishes			House for life

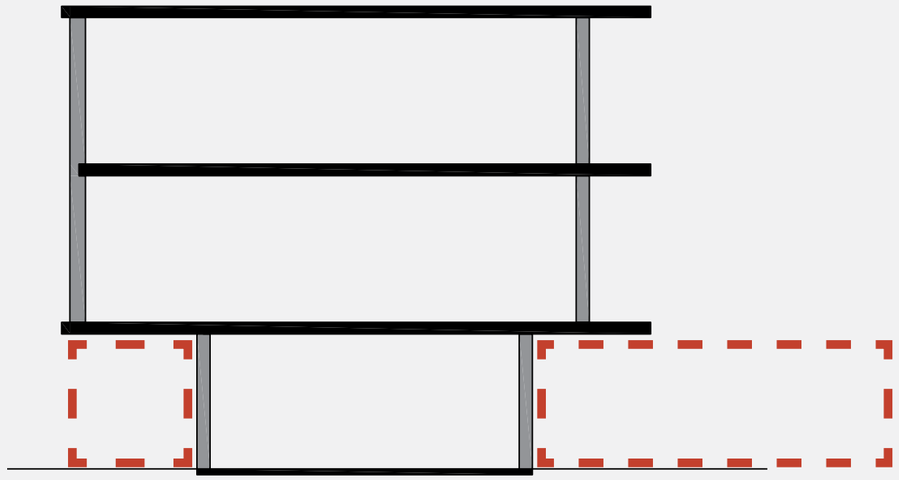
Project

Variation in housing types and functions



Project

Different options to expand home



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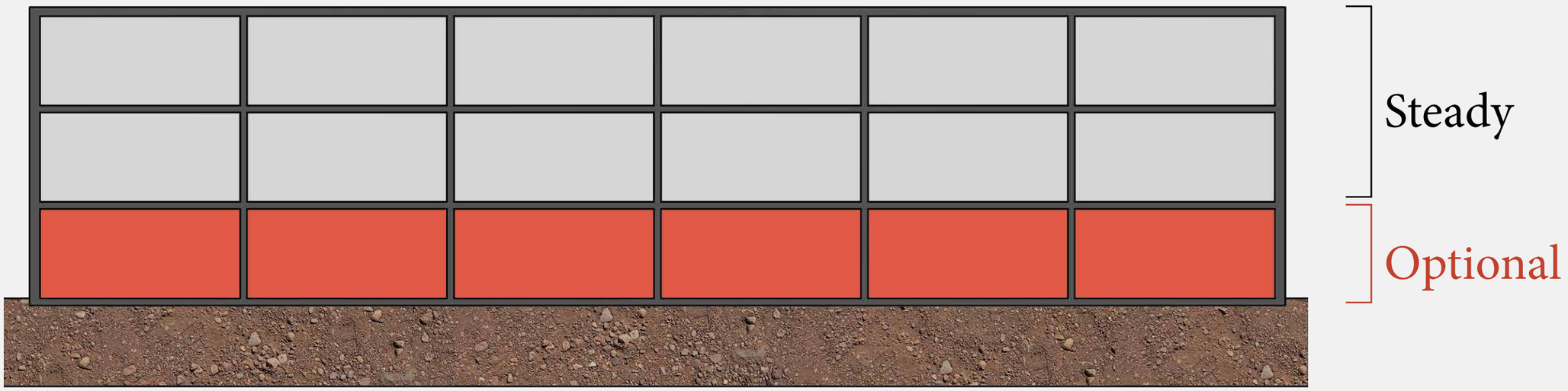
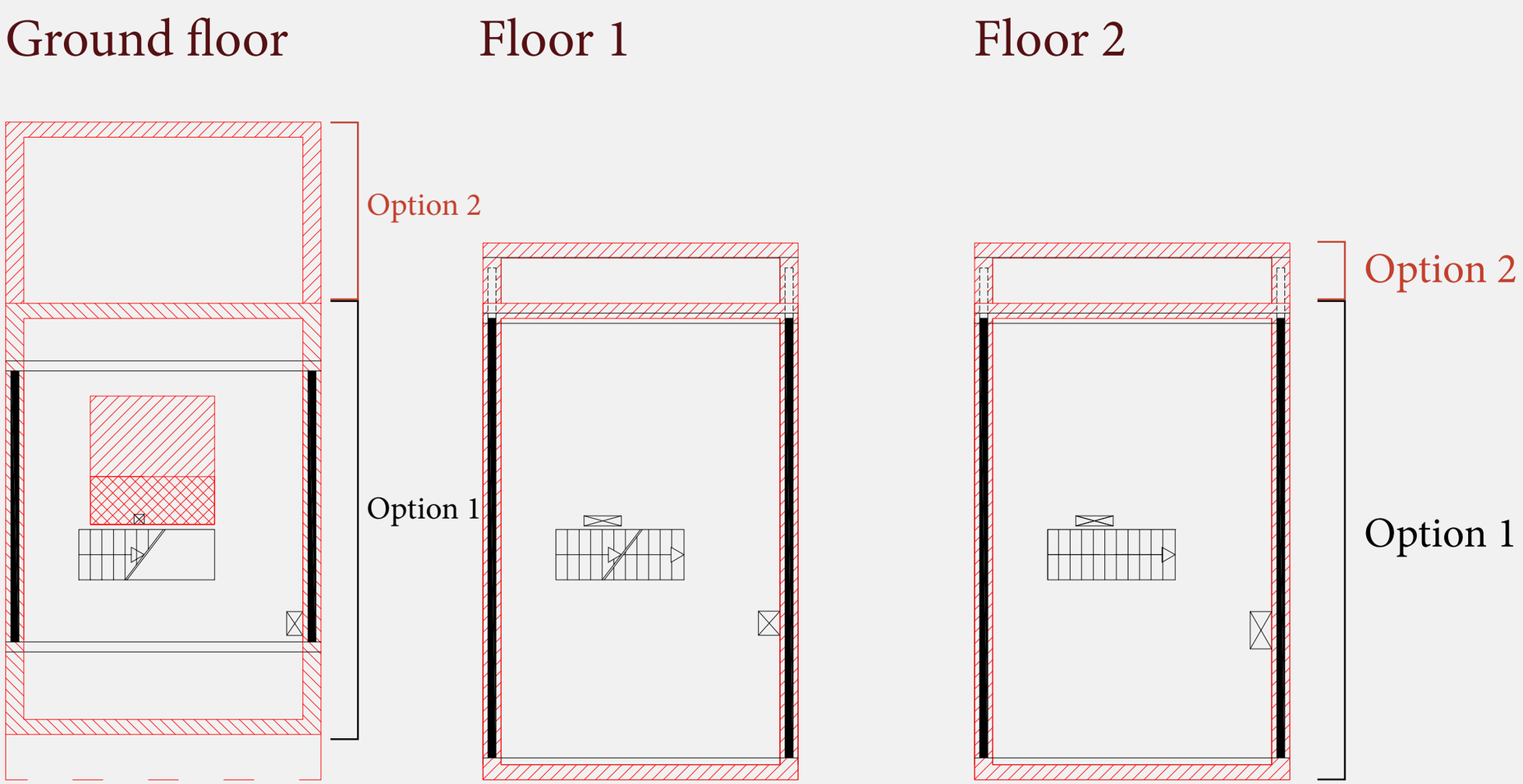


Project

Different options to expand home



Project

Different options to expand home

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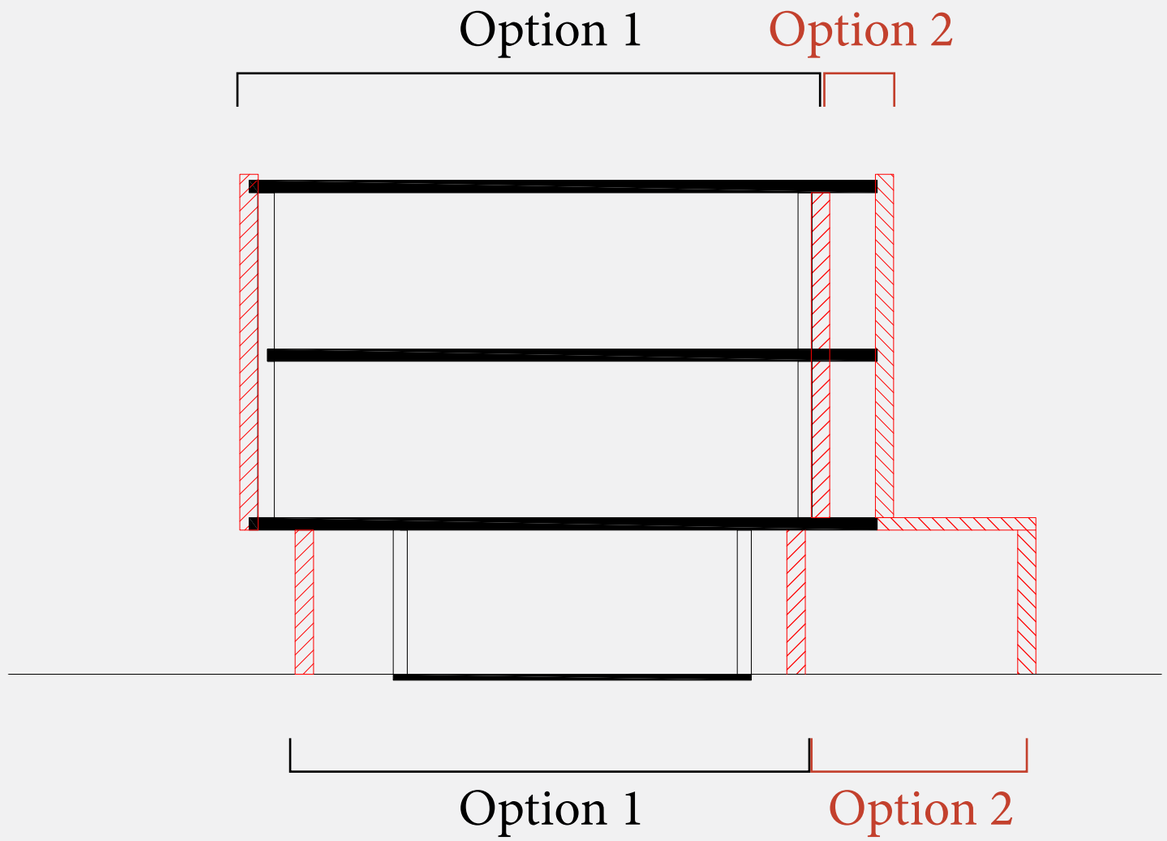

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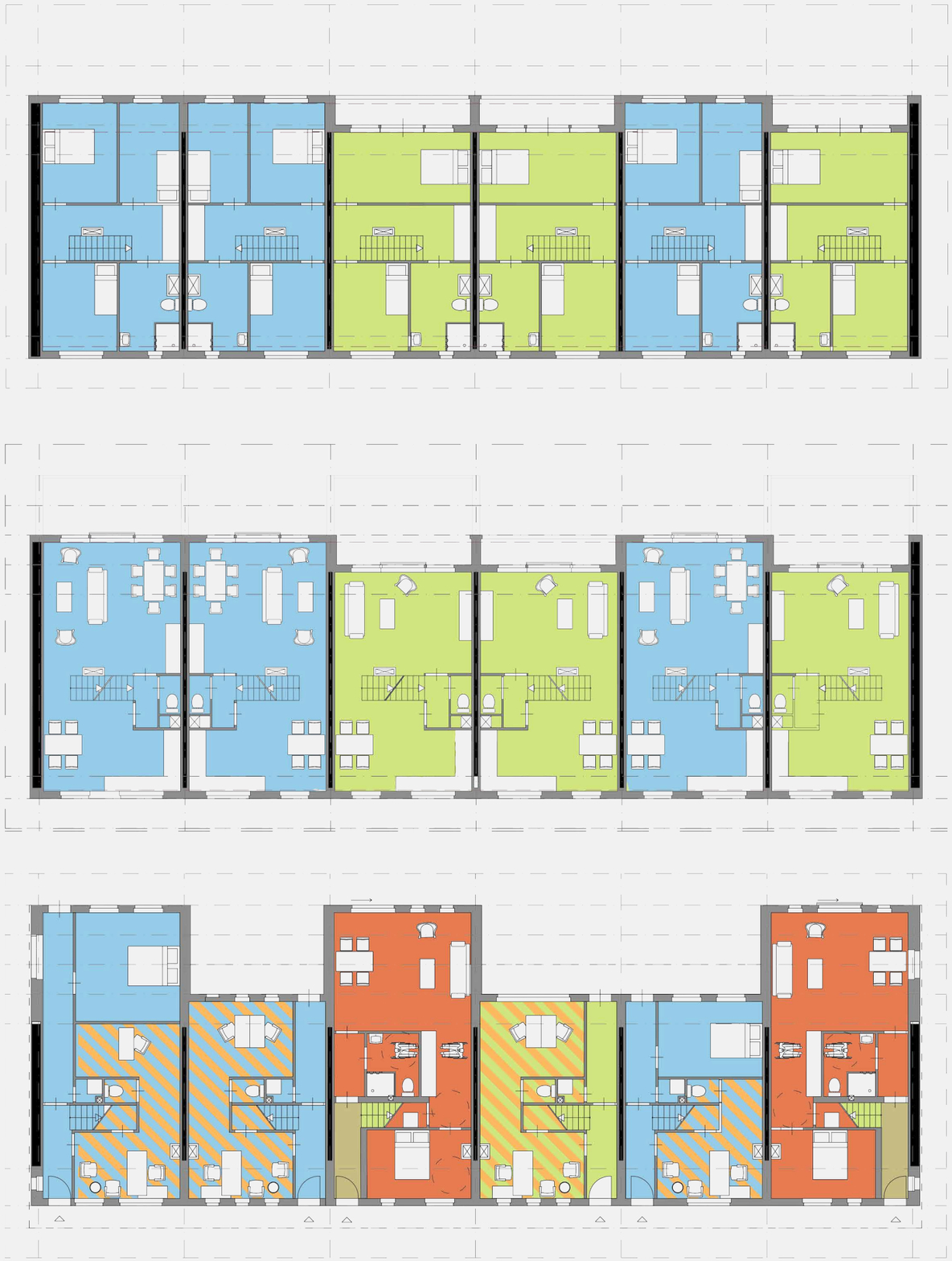
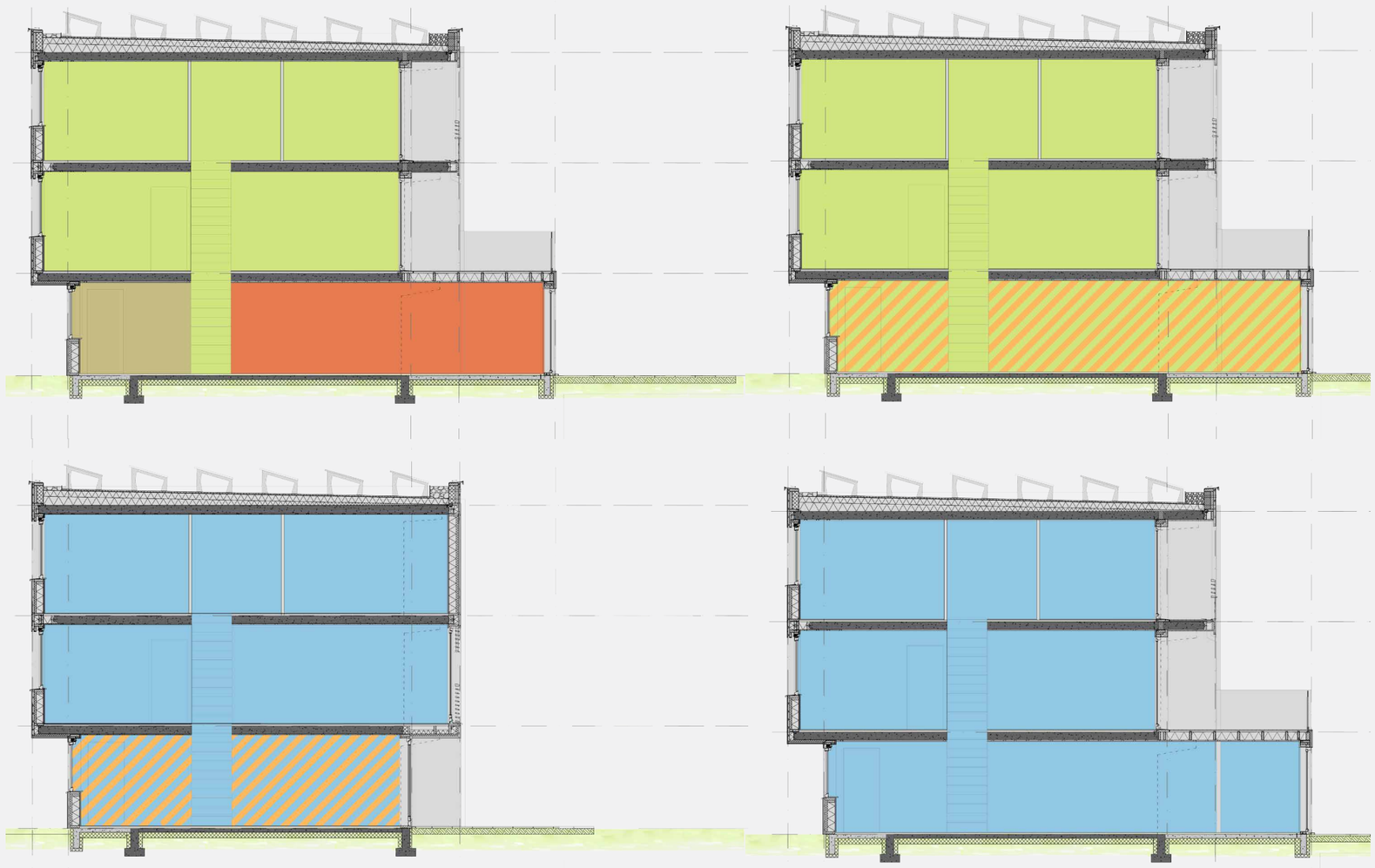
Project
Combinations



Project
Combinations



Project

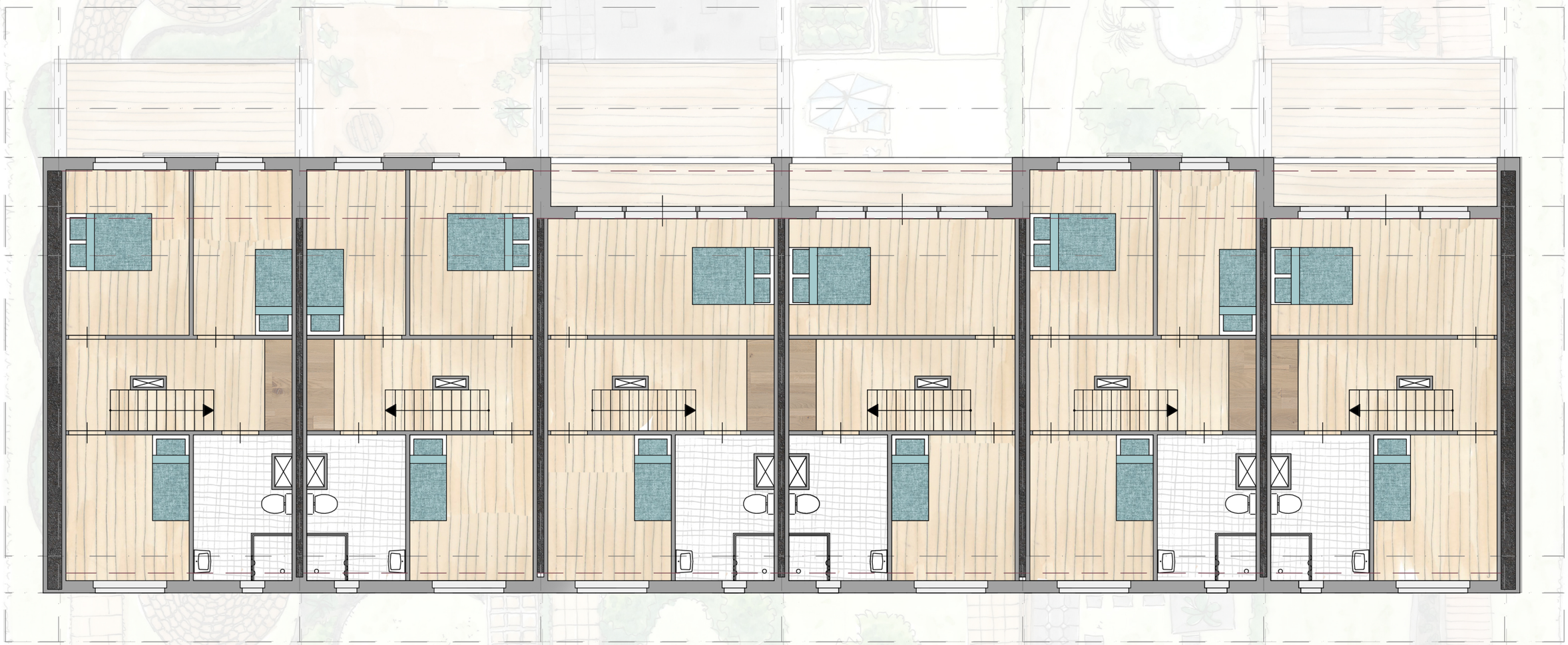
Ground floor: Variation

Project

First floor: two options

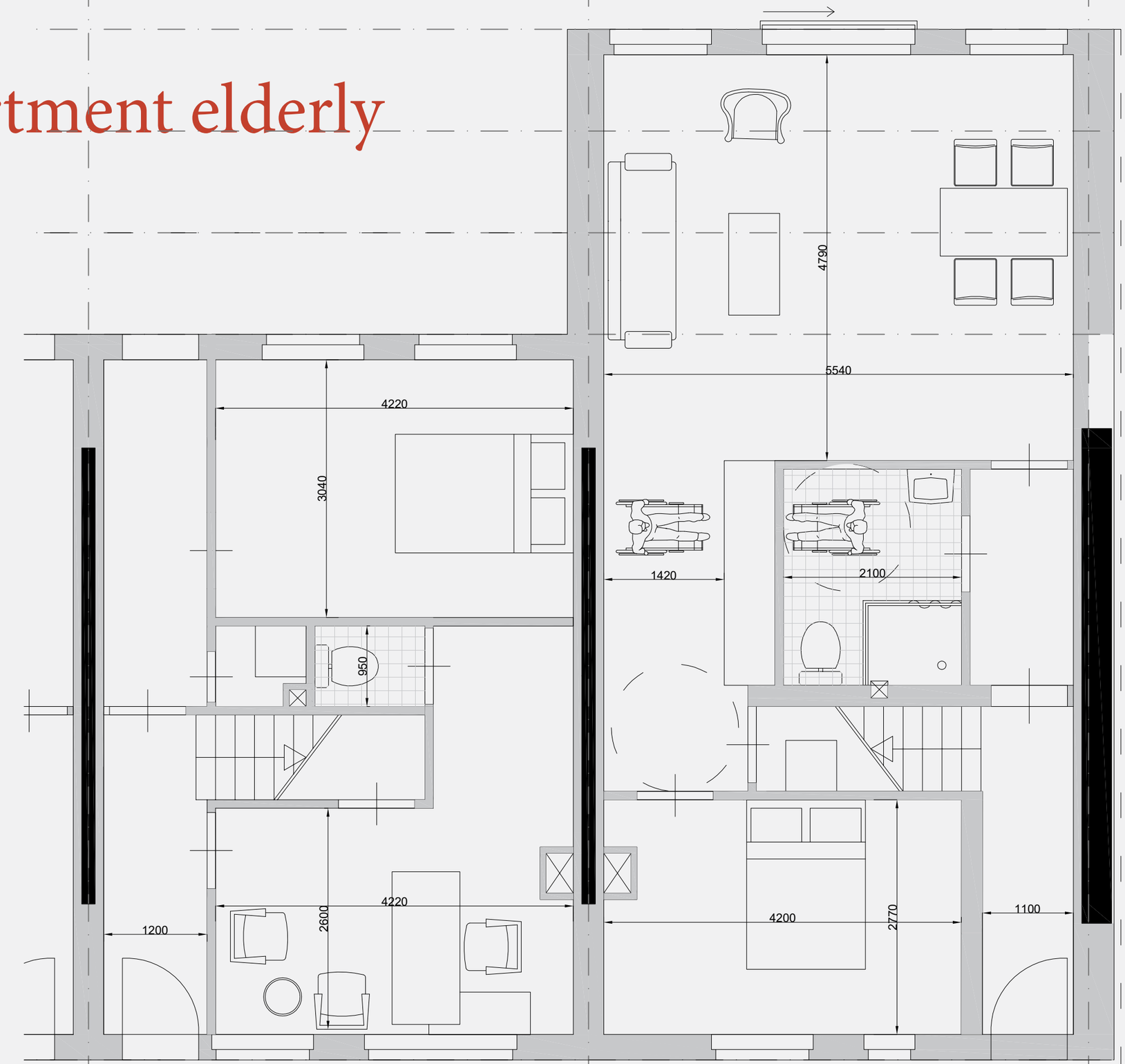
Project

Second floor: two options



Project

One floor apartment elderly



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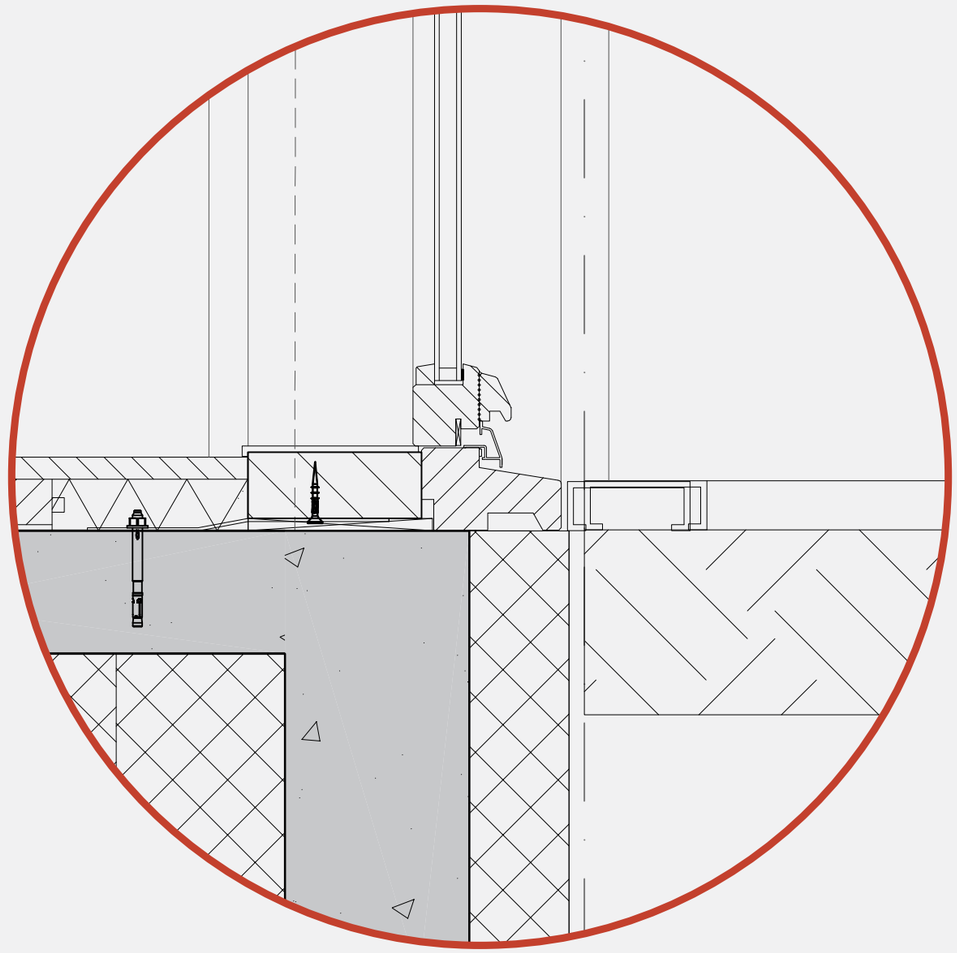
Project

No threshold surroundings

Project

Low door thresholds



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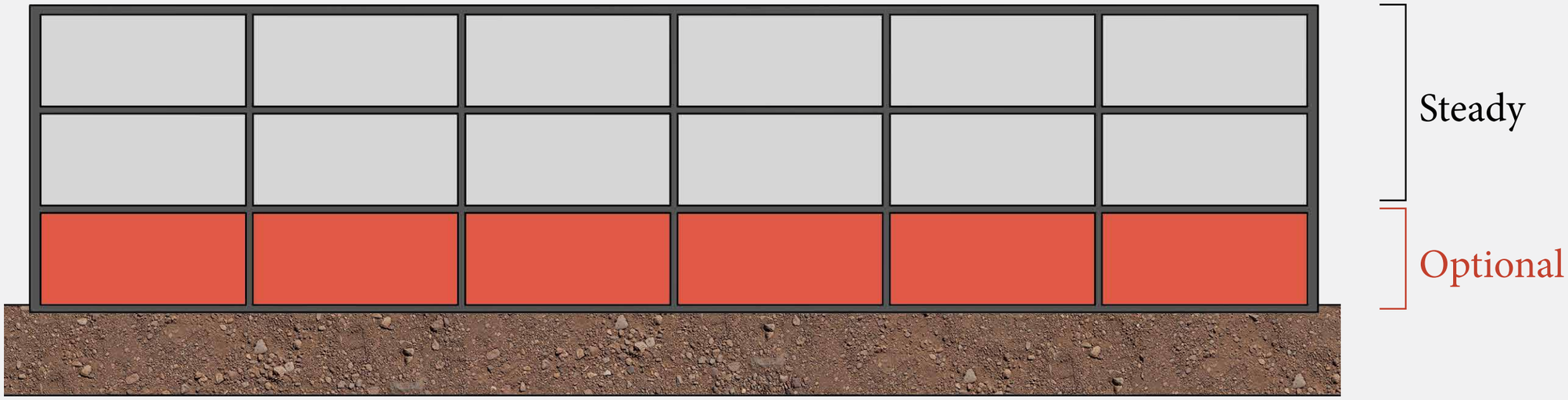
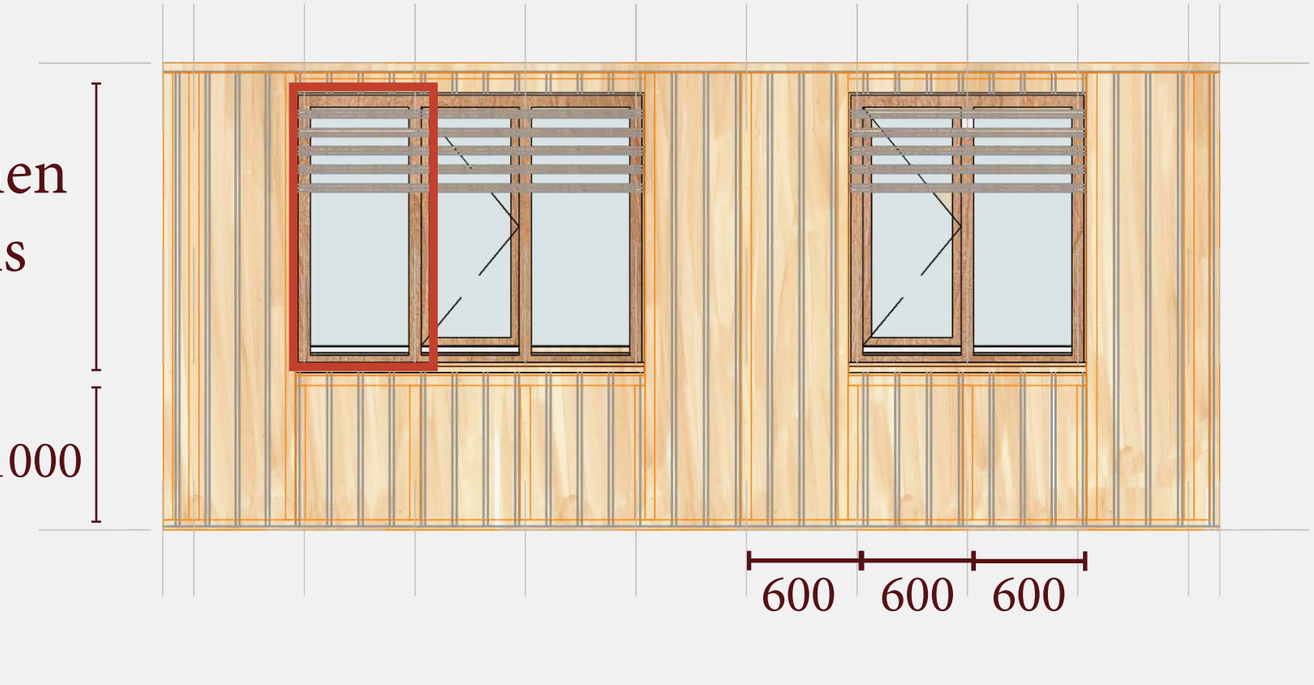


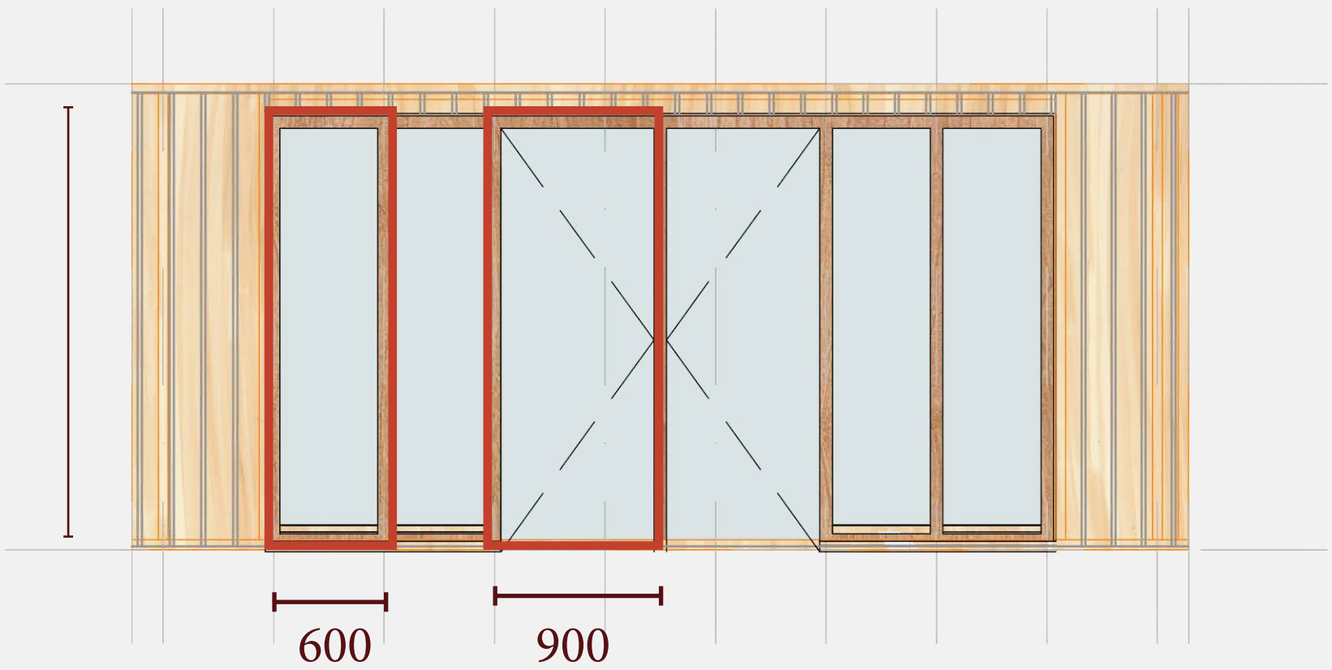
Project

Façade system

Windows for kitchen and sleeping rooms and bathrooms



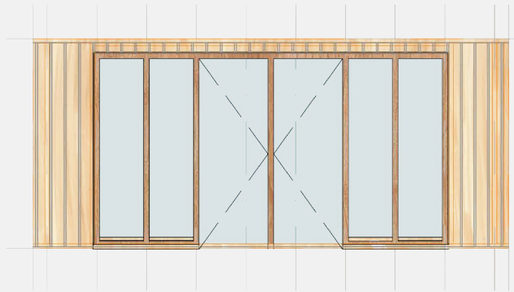
Windows for work spaces and living rooms



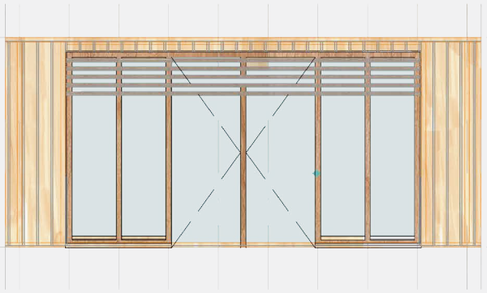
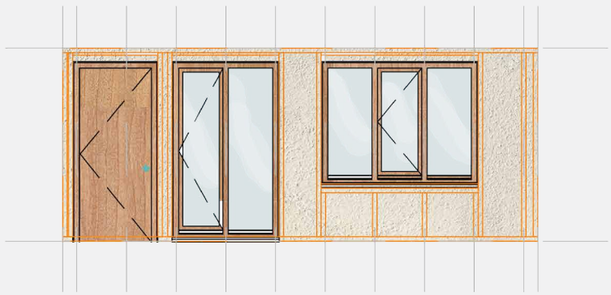
Project

Façade possibilities








Project
Façade

Front façade

Side façades

East façade

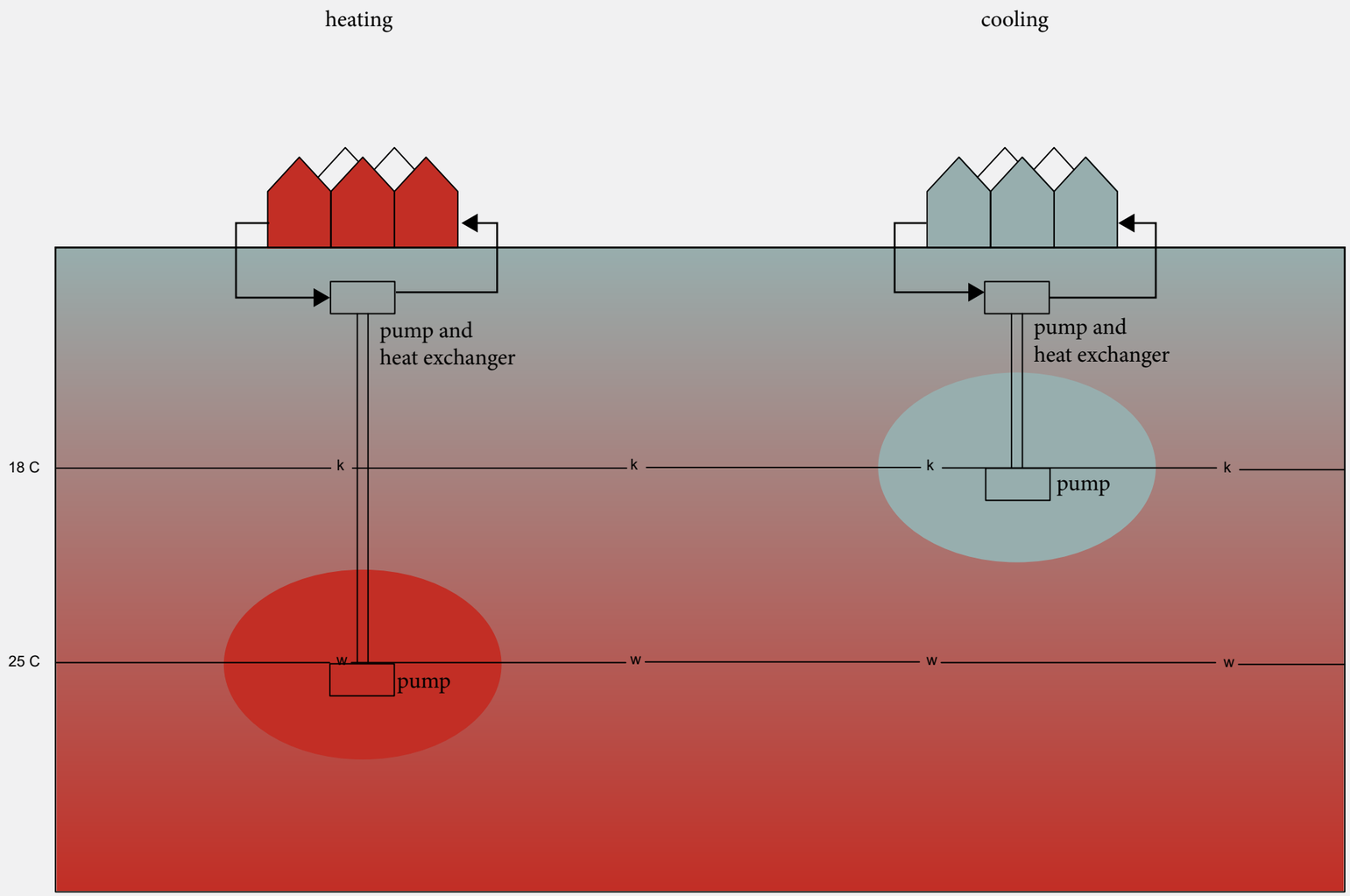
Back façade

Project
Street

Efficiëncy in energy use & CO2 absorption

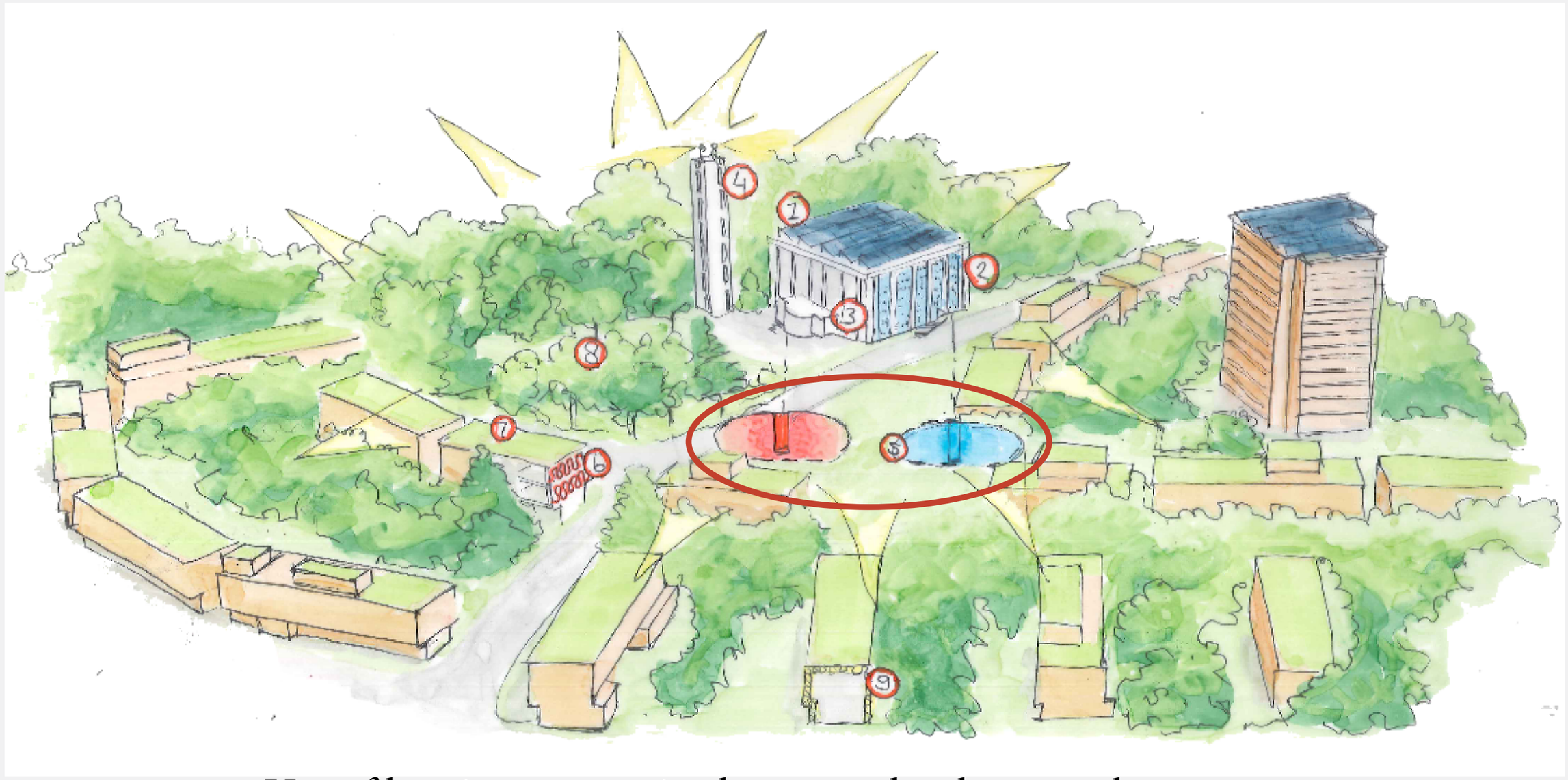
Project

Energy efficiency



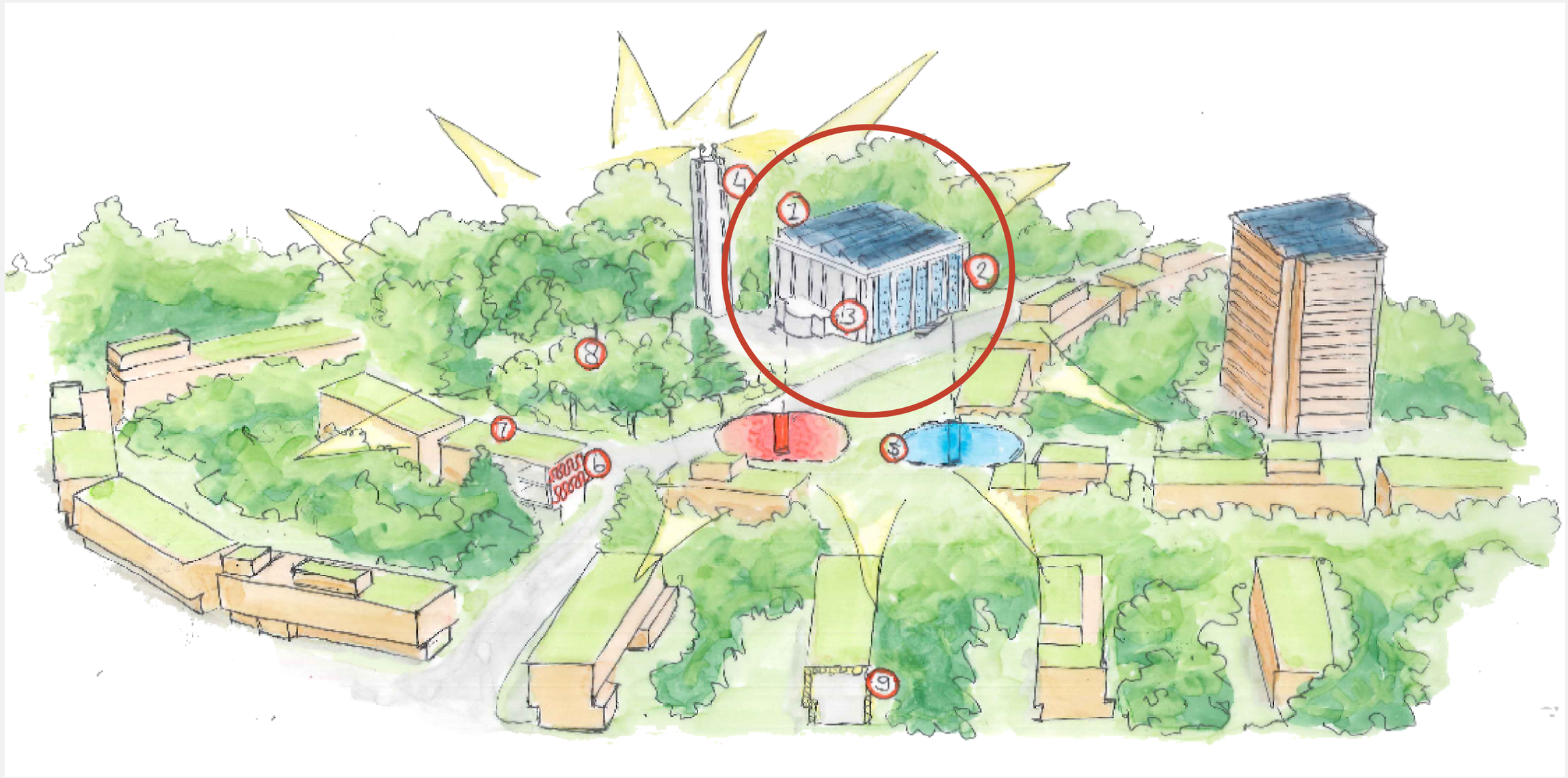
Using water from existing mine shafts to heat and cool the residential building in the neighbourhood

Project
Energy efficiency



Use of heating pumps in the ground to heat up the water from tapwater for several building blocks

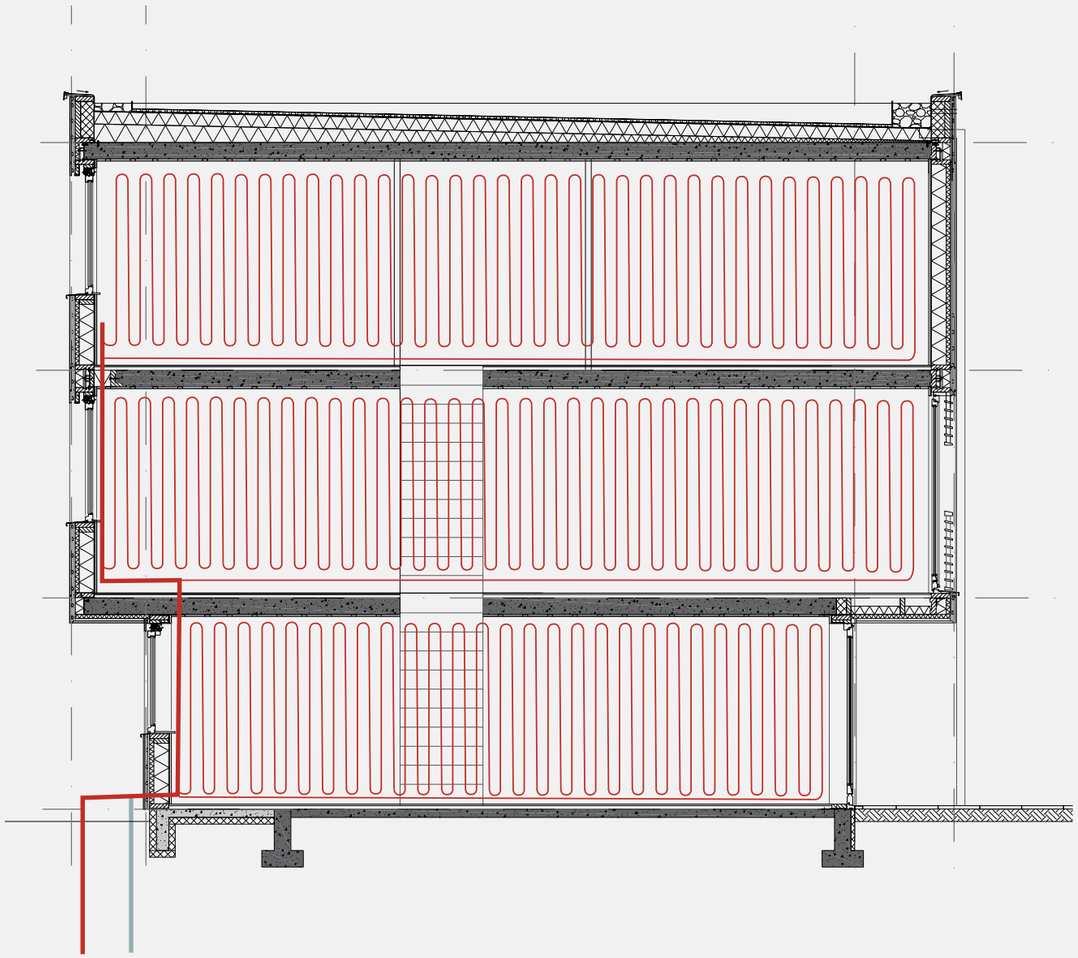
Project
Energy efficiency

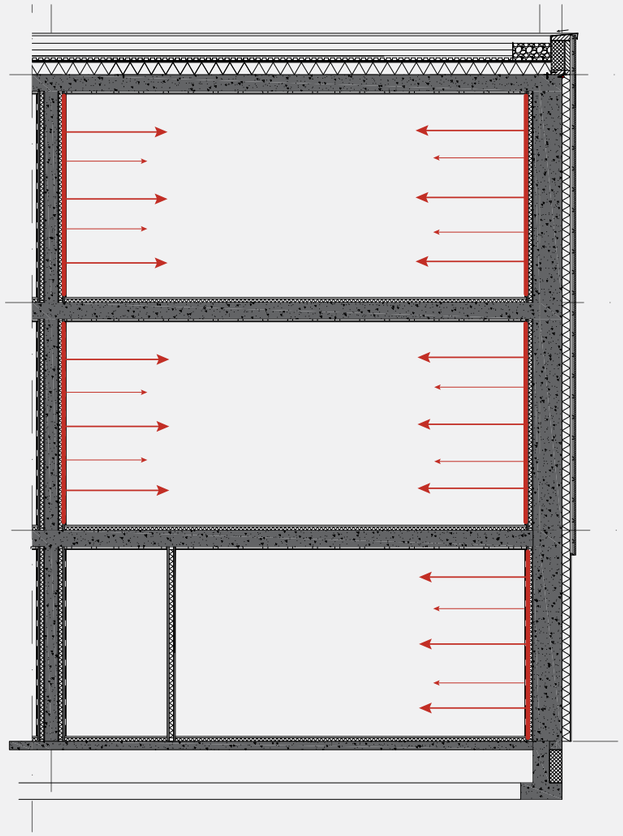


Solar panels for pumps

Project

Energy efficiency





Low temperature heating system

Project

Energy efficiency

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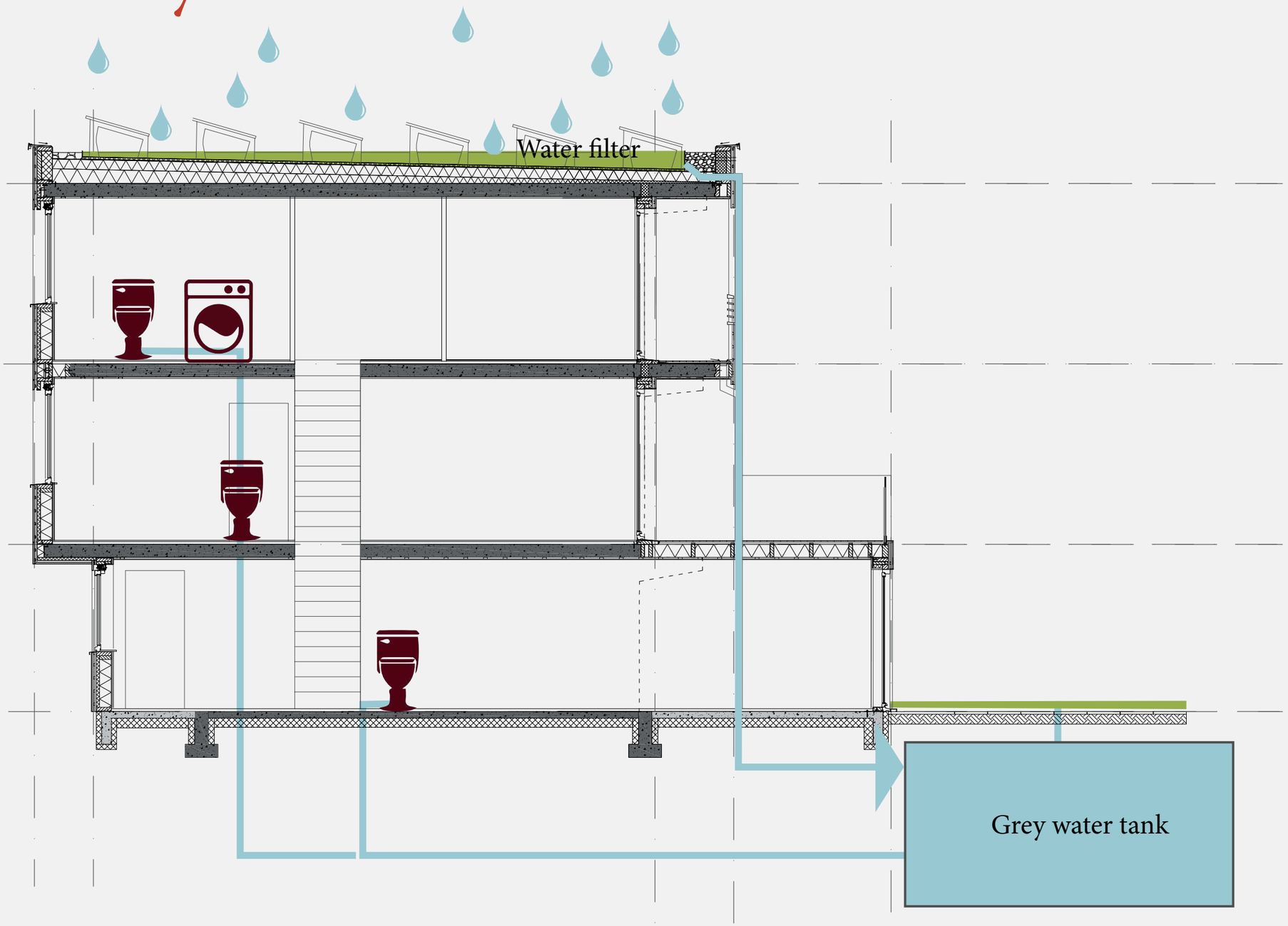

Project

Energy efficiency

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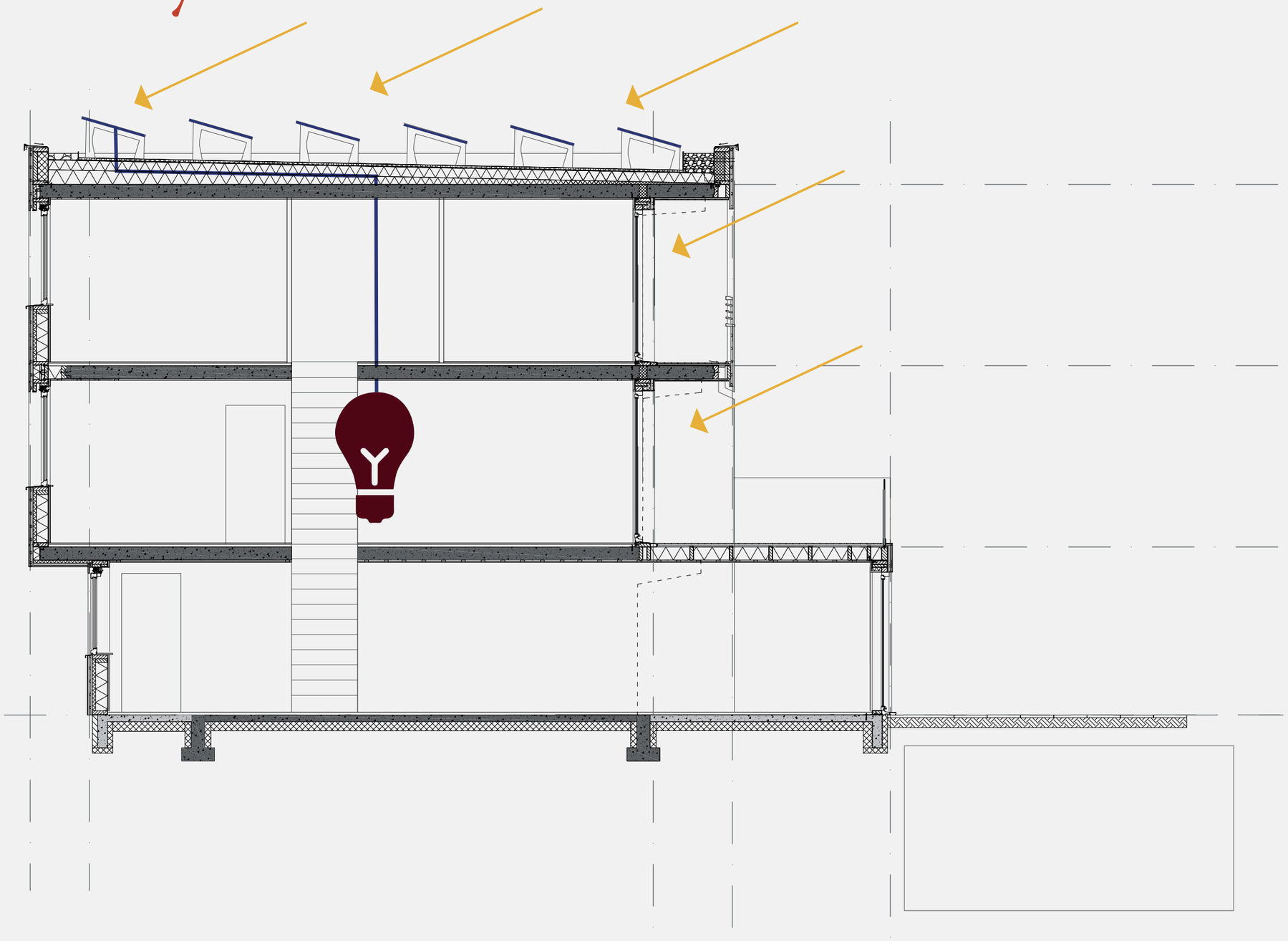
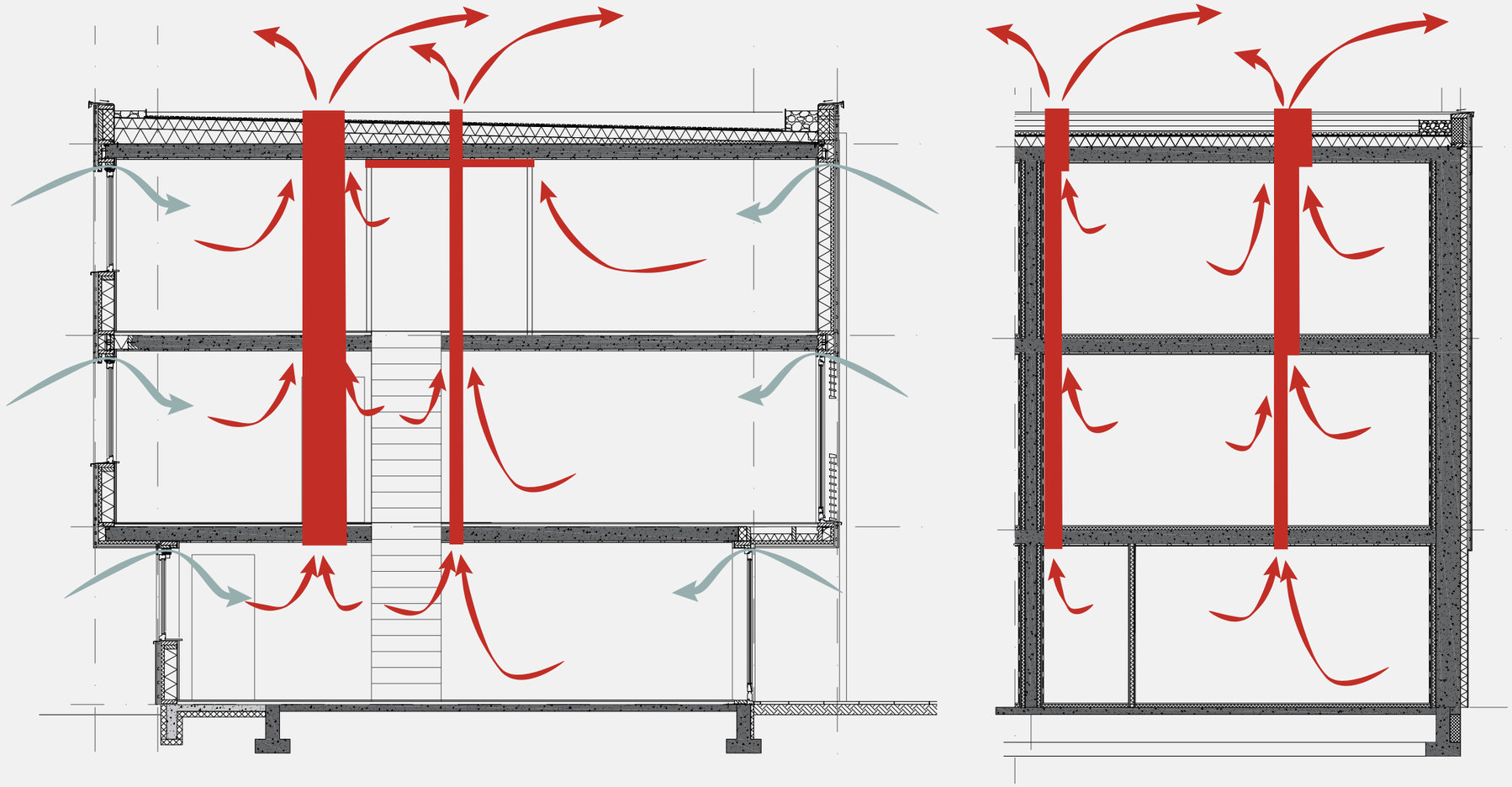


Project

Energy efficiency



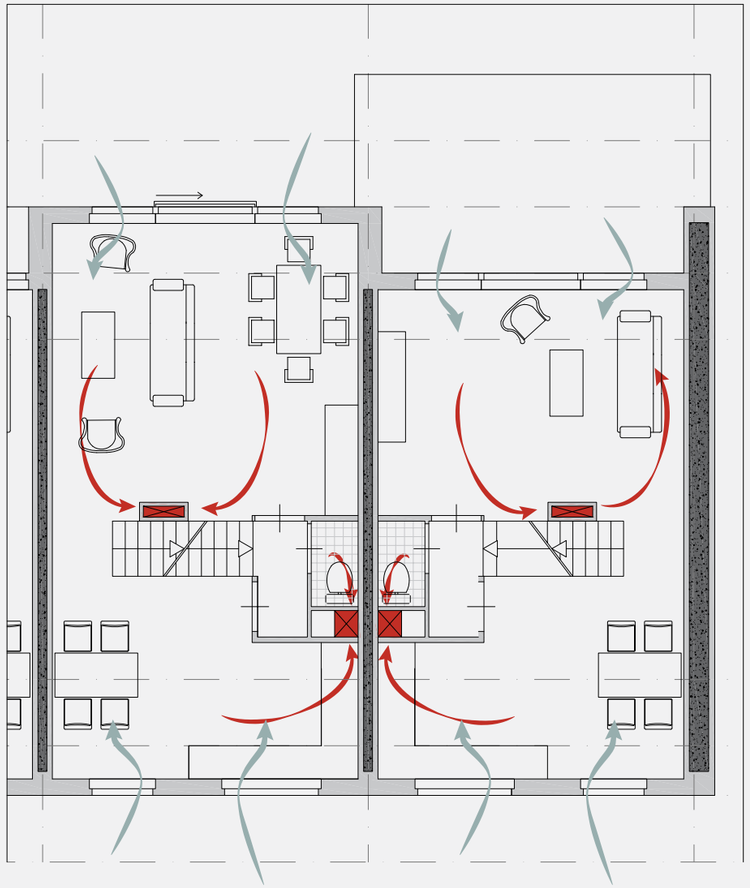
Demand Control Ventilation (DCV)

Project

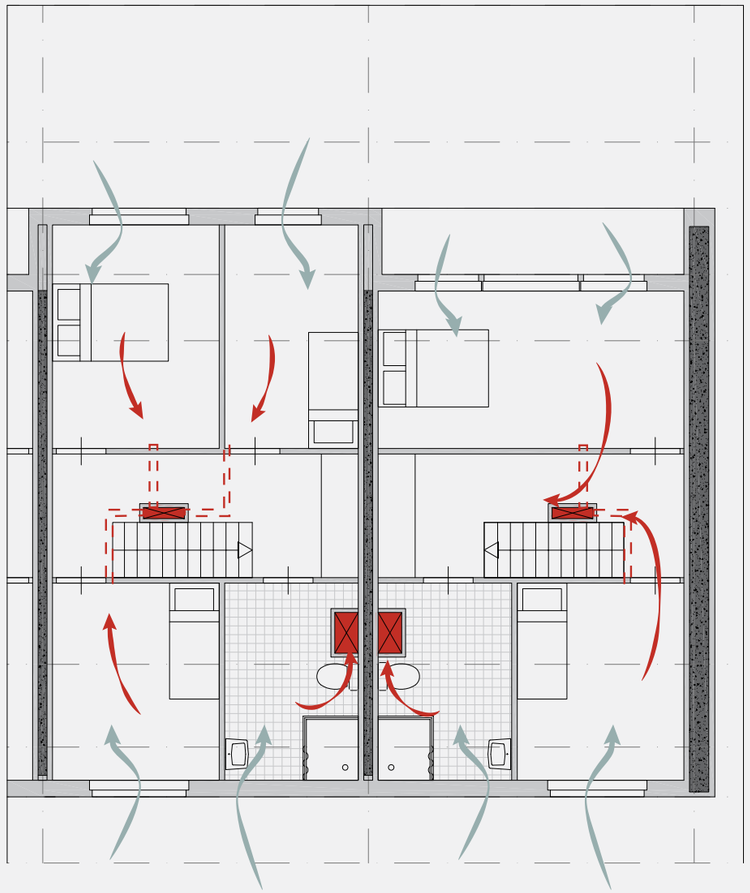
Energy efficiency

Ground floor

First floor



Second floor



Project

Energy efficiency

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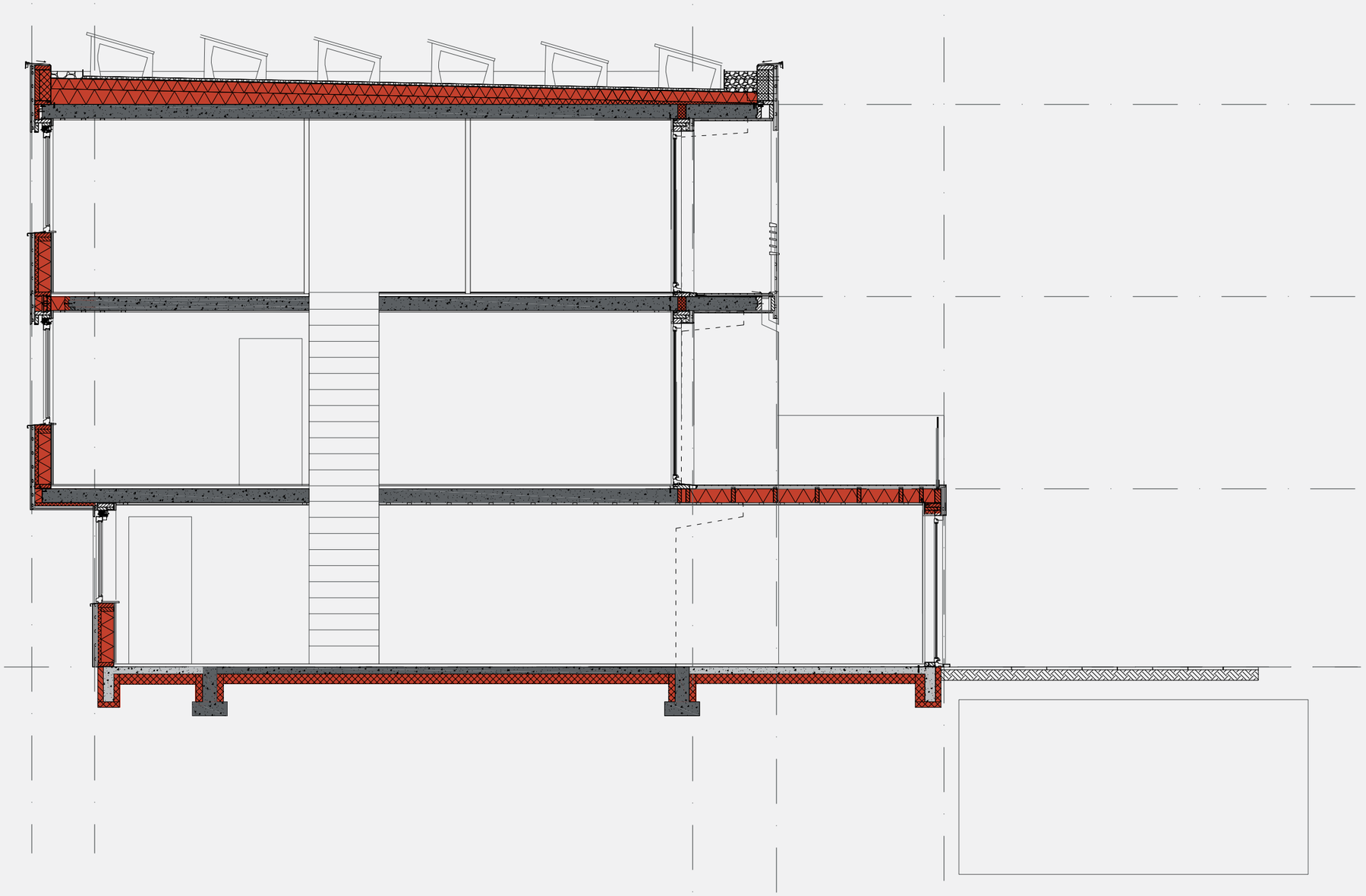
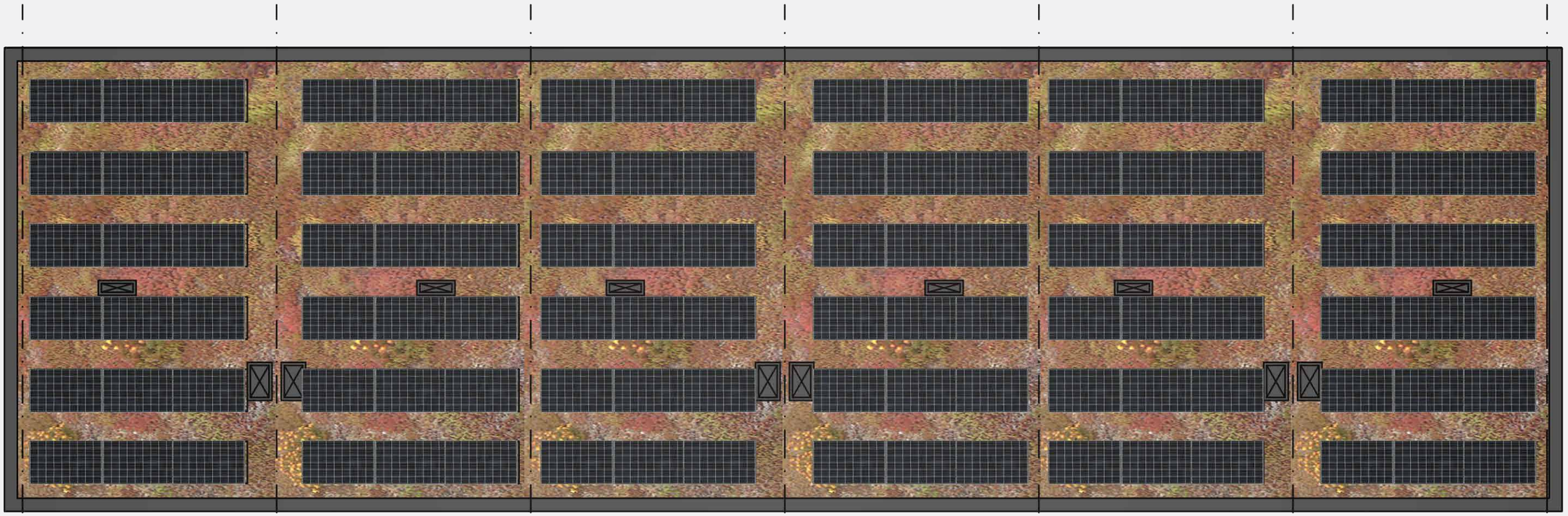


Project

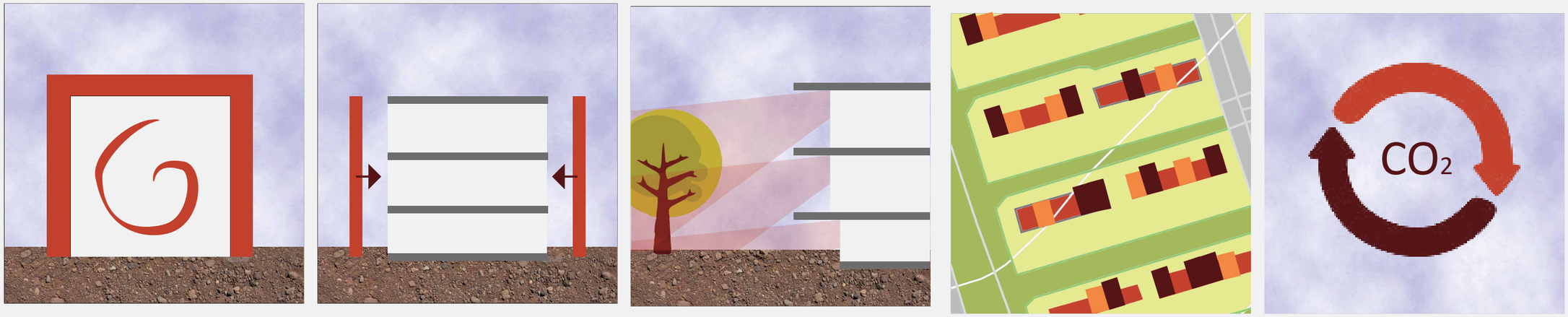
CO2 absorption

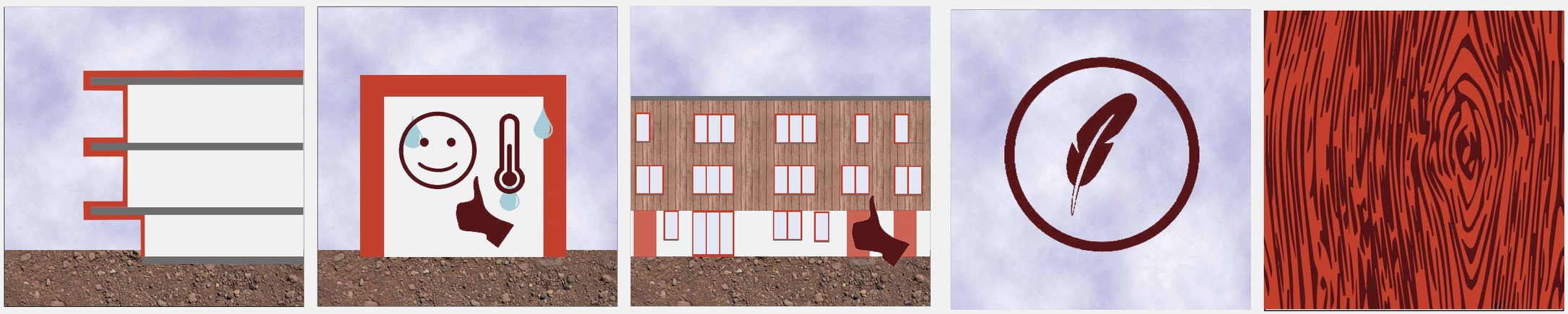
Project

Energy efficiency & CO2 absorption



Green roof and solar panels

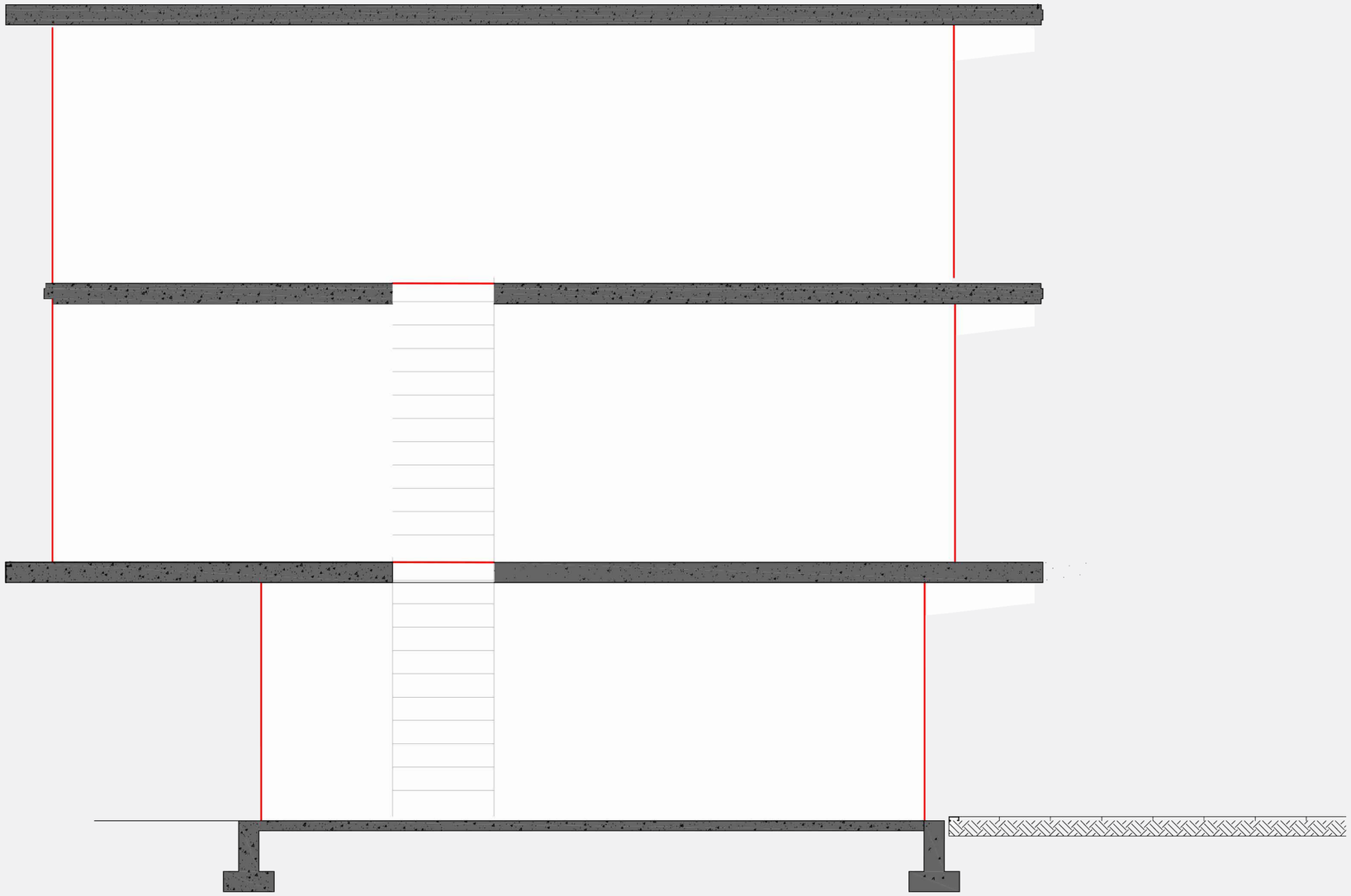




Requirements for the façade from research paper

Project
Construction

Project
Construction



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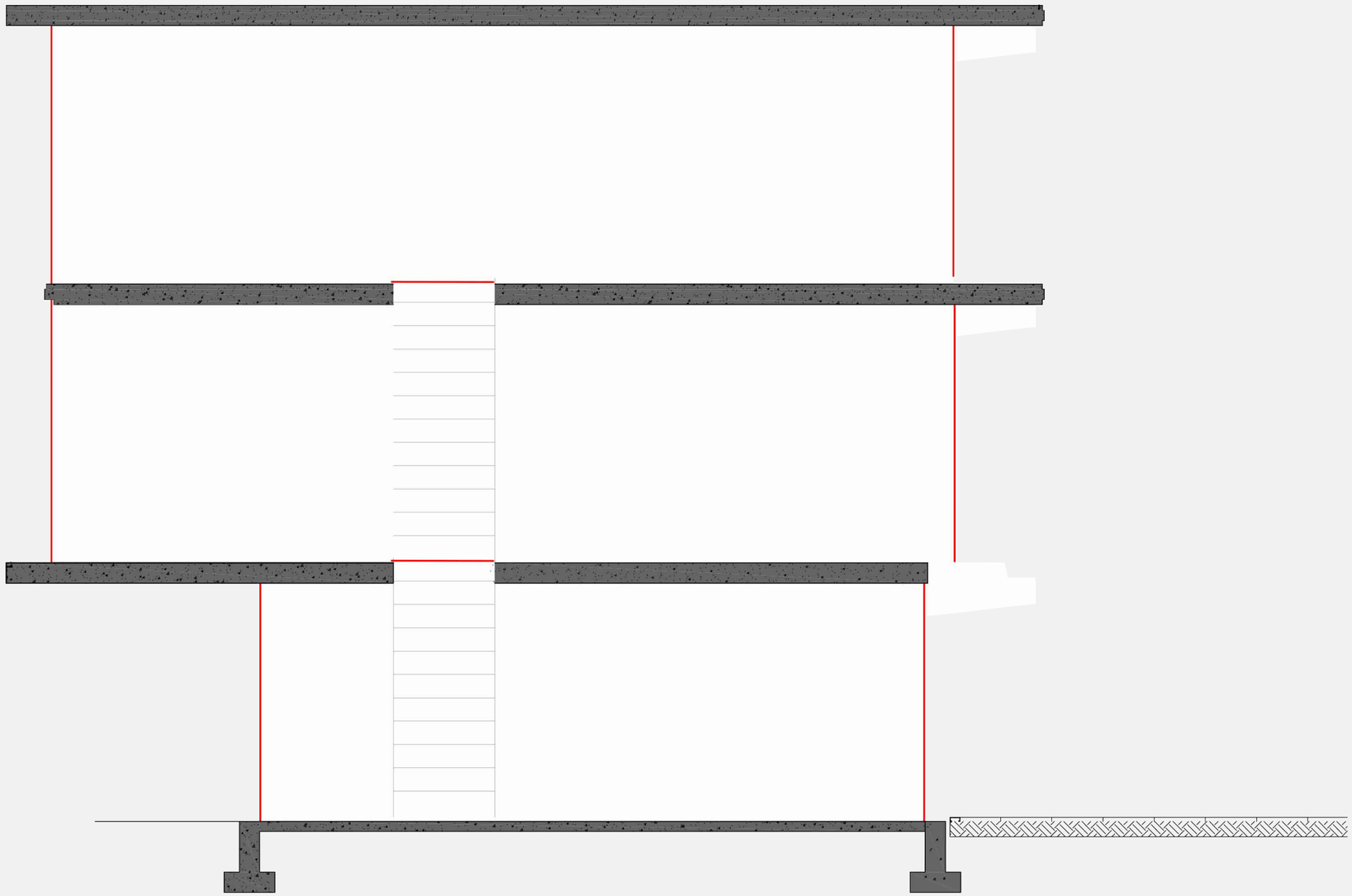

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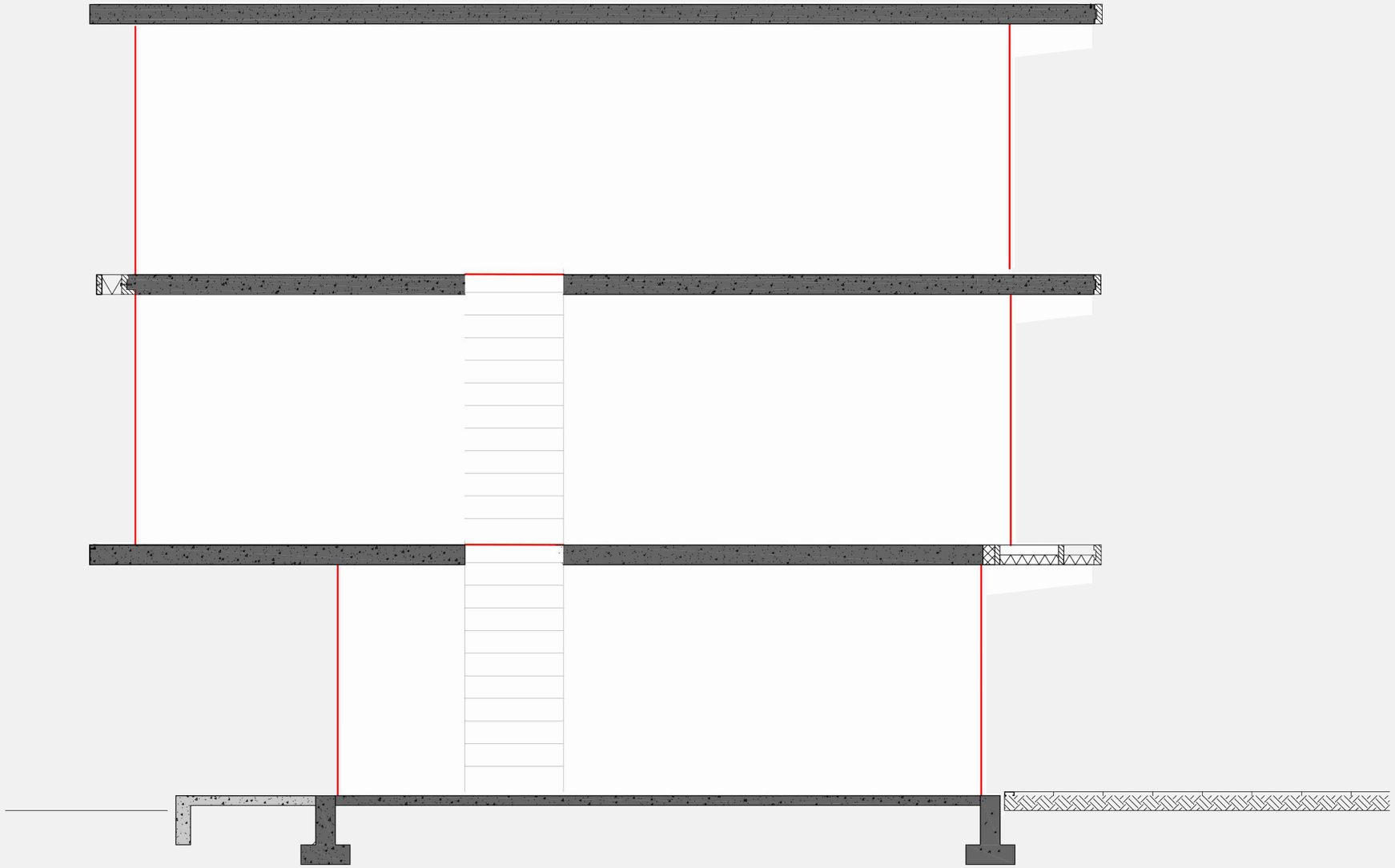

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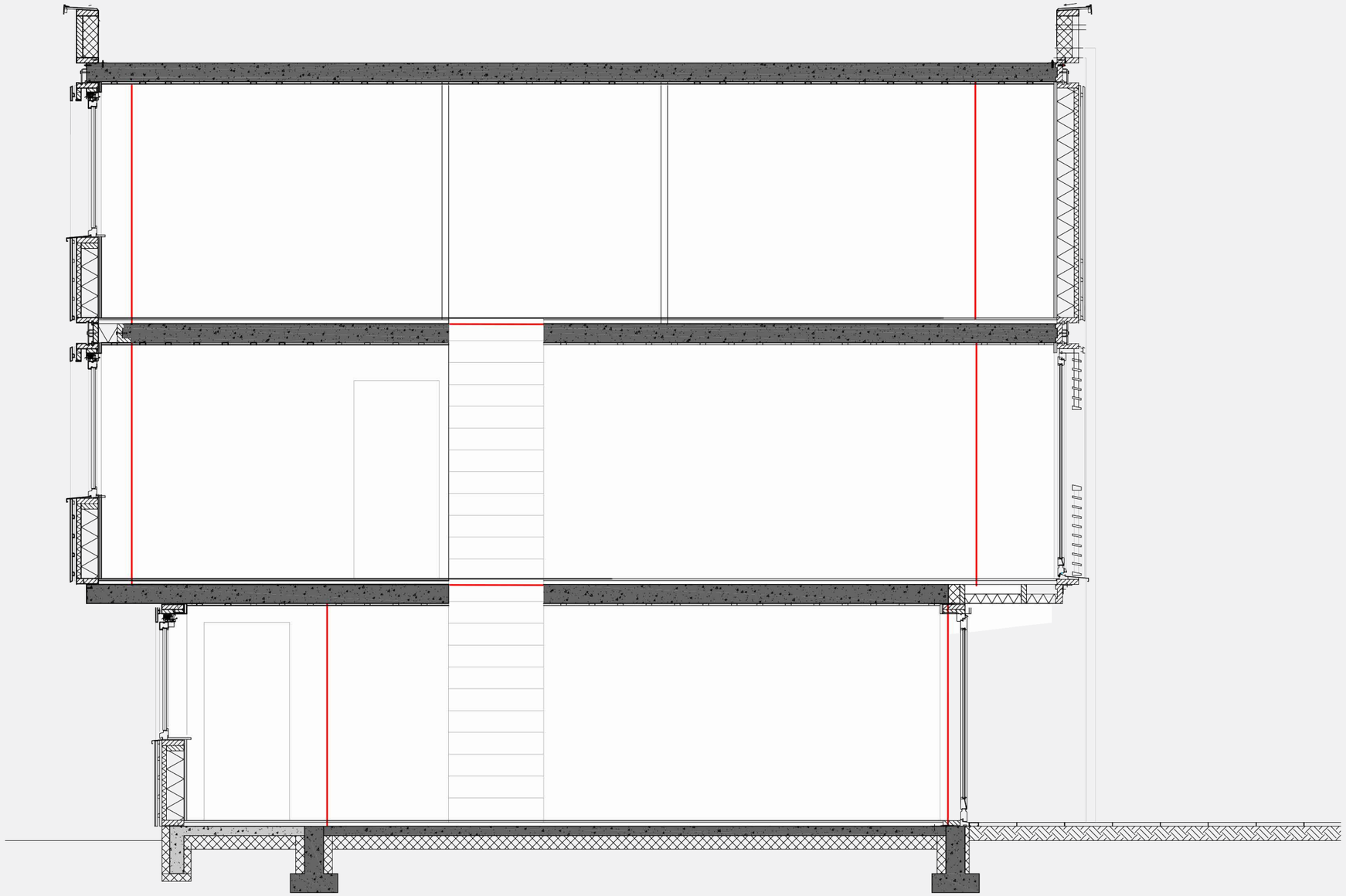

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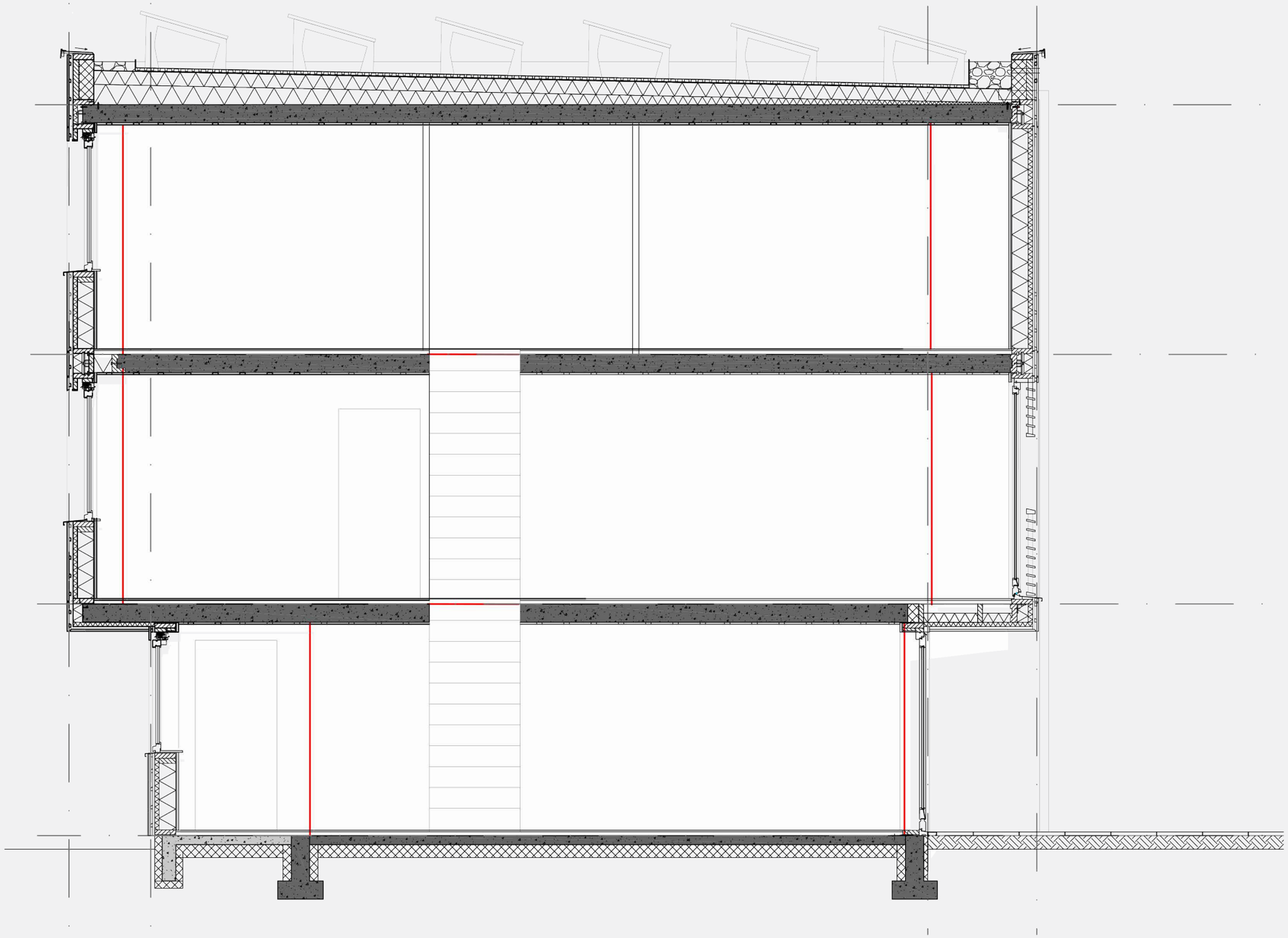
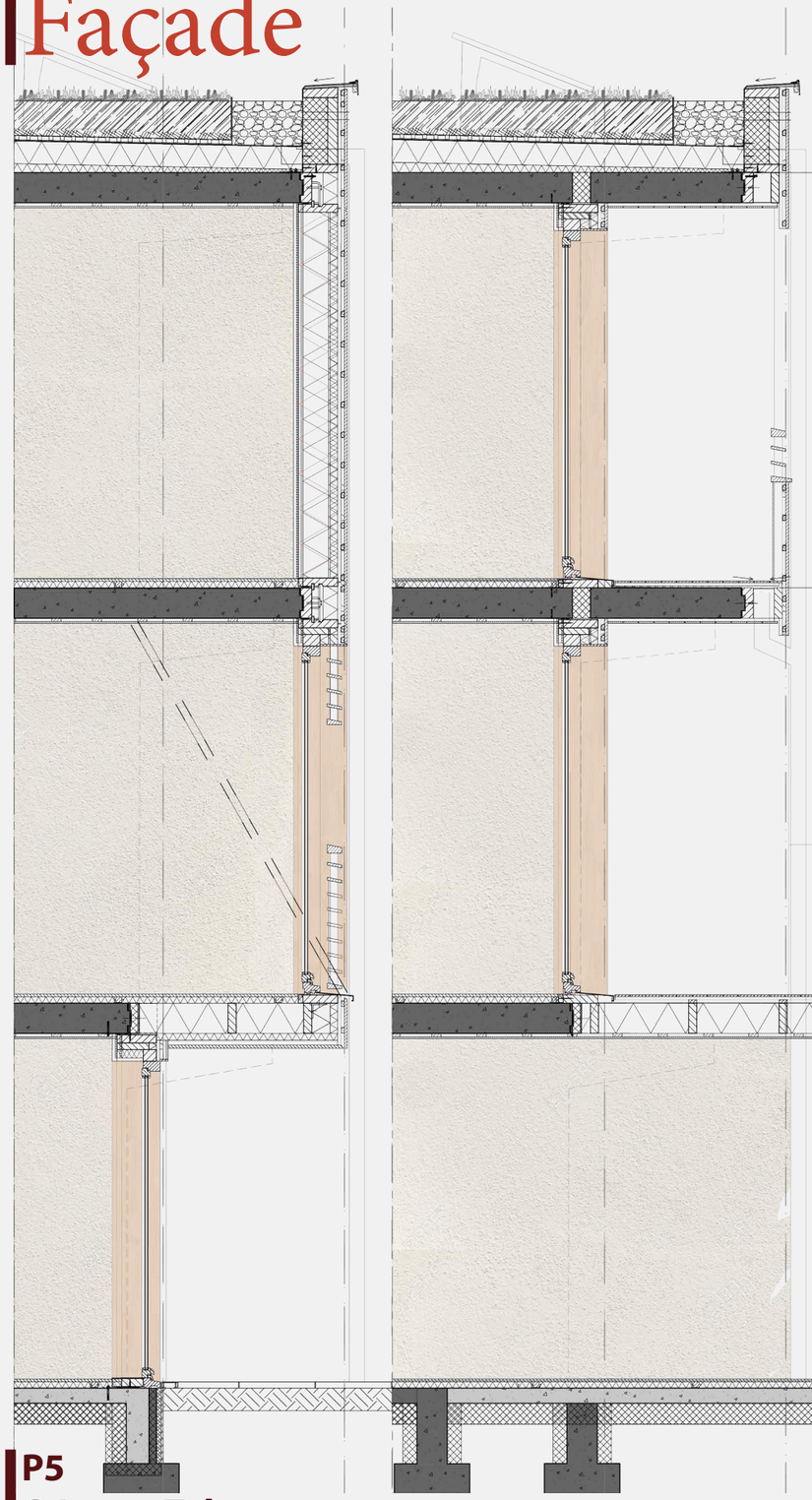


Project
Façade

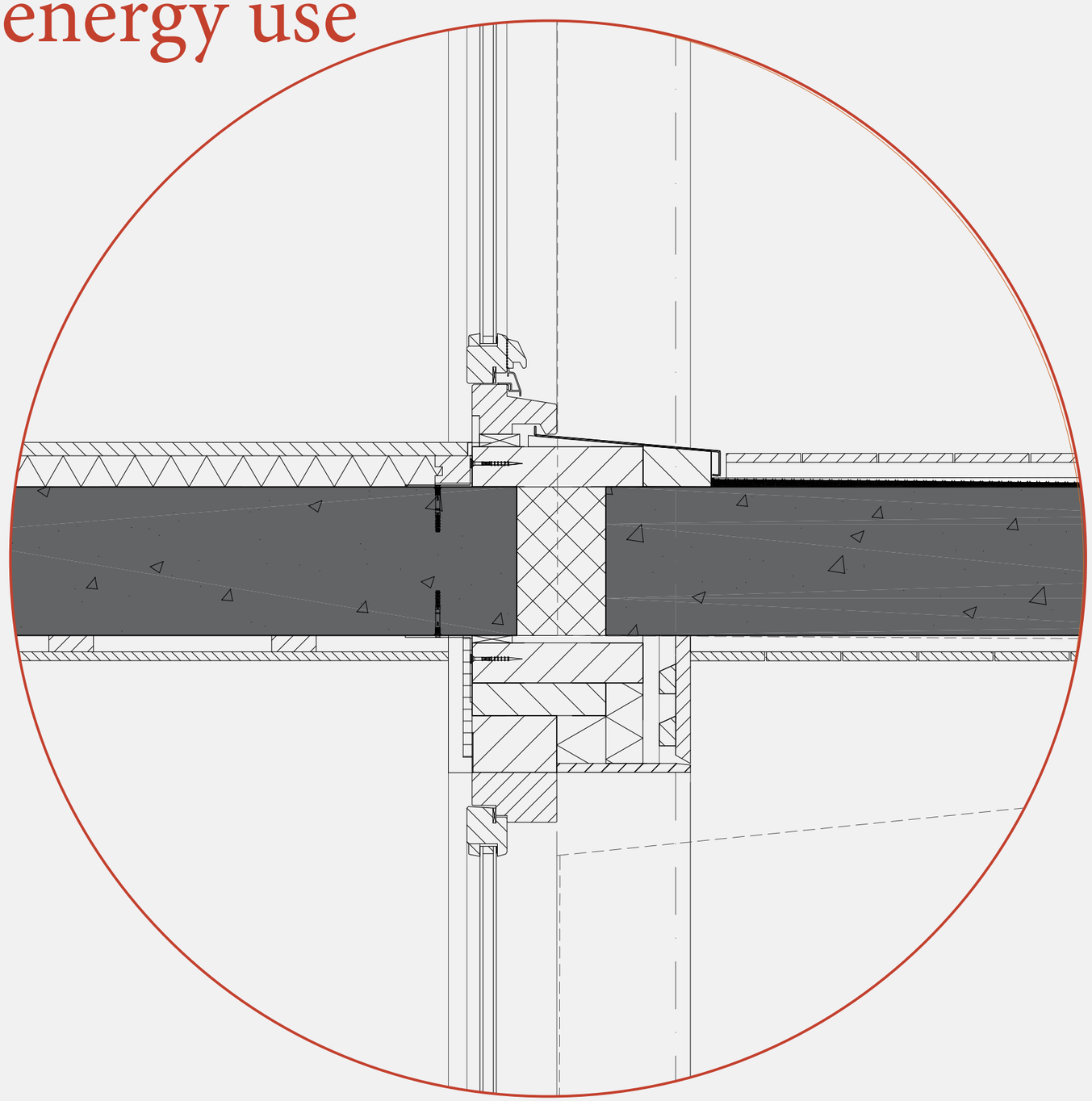
Project

Façade



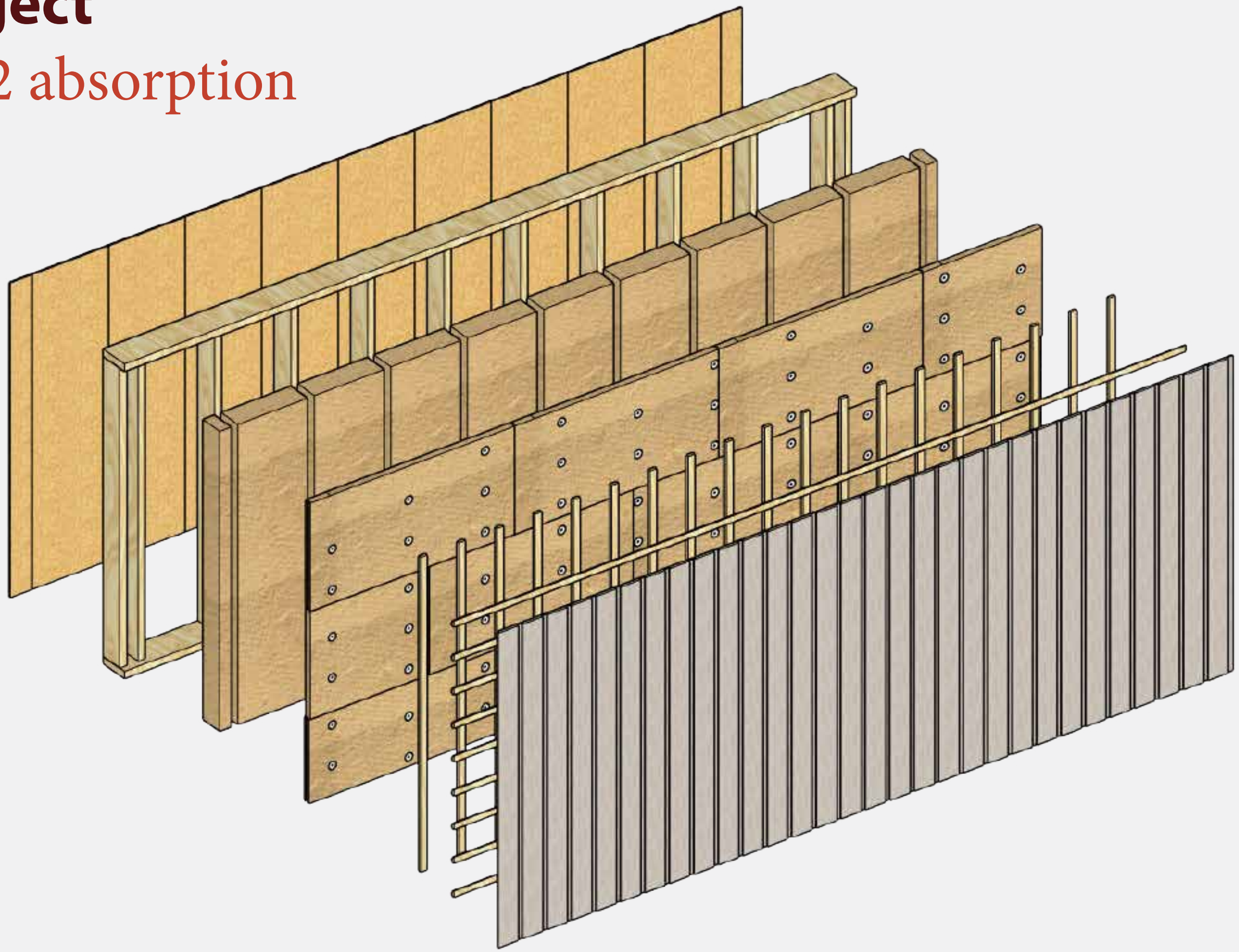
Project

Efficiency in energy use



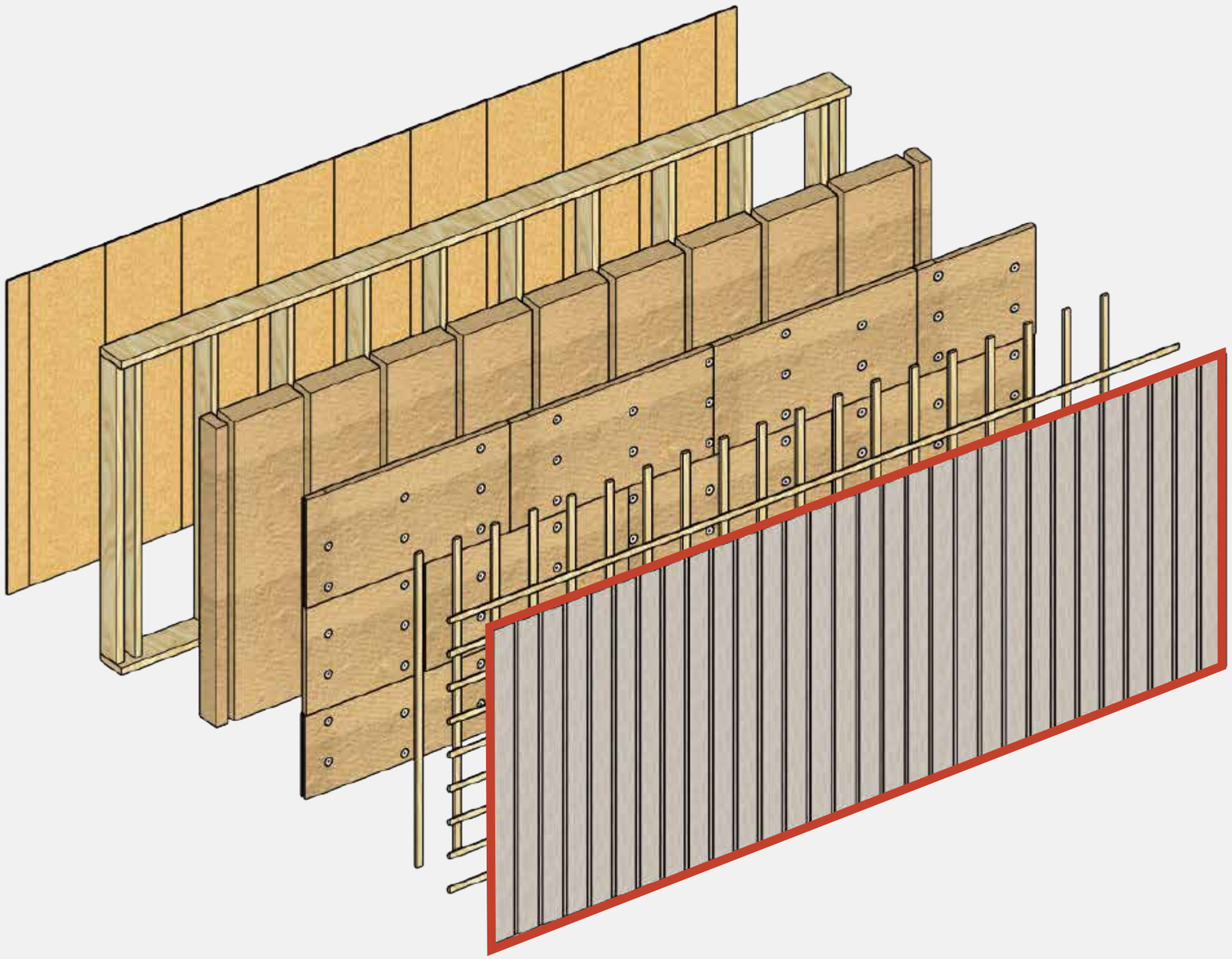
Project

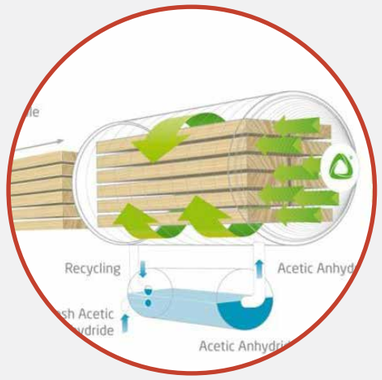
CO2 absorption



Project

CO2 absorption & efficiency in energy use





P5
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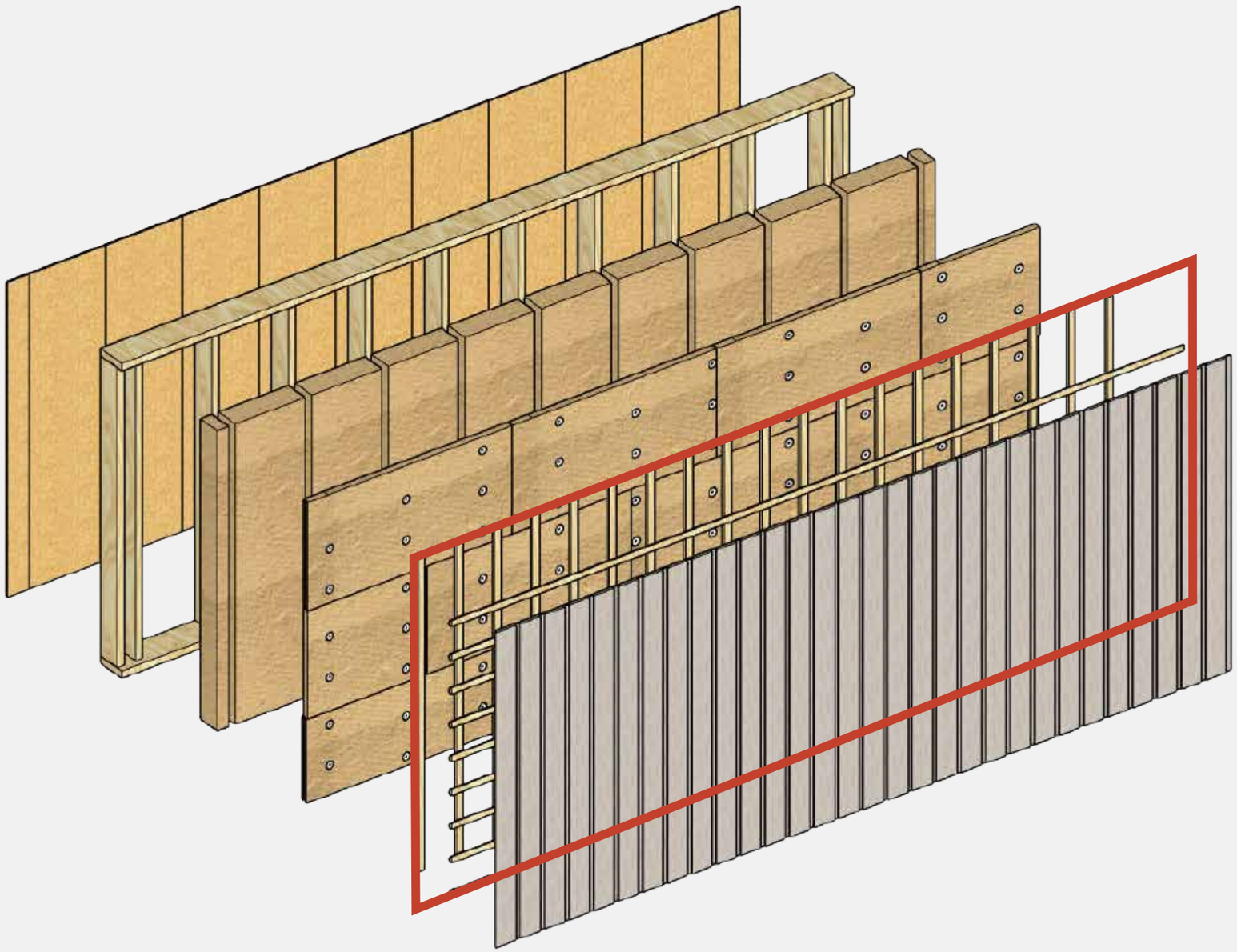
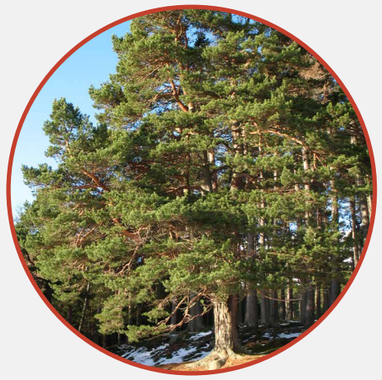
Project

CO2 absorption & efficiency in energy use





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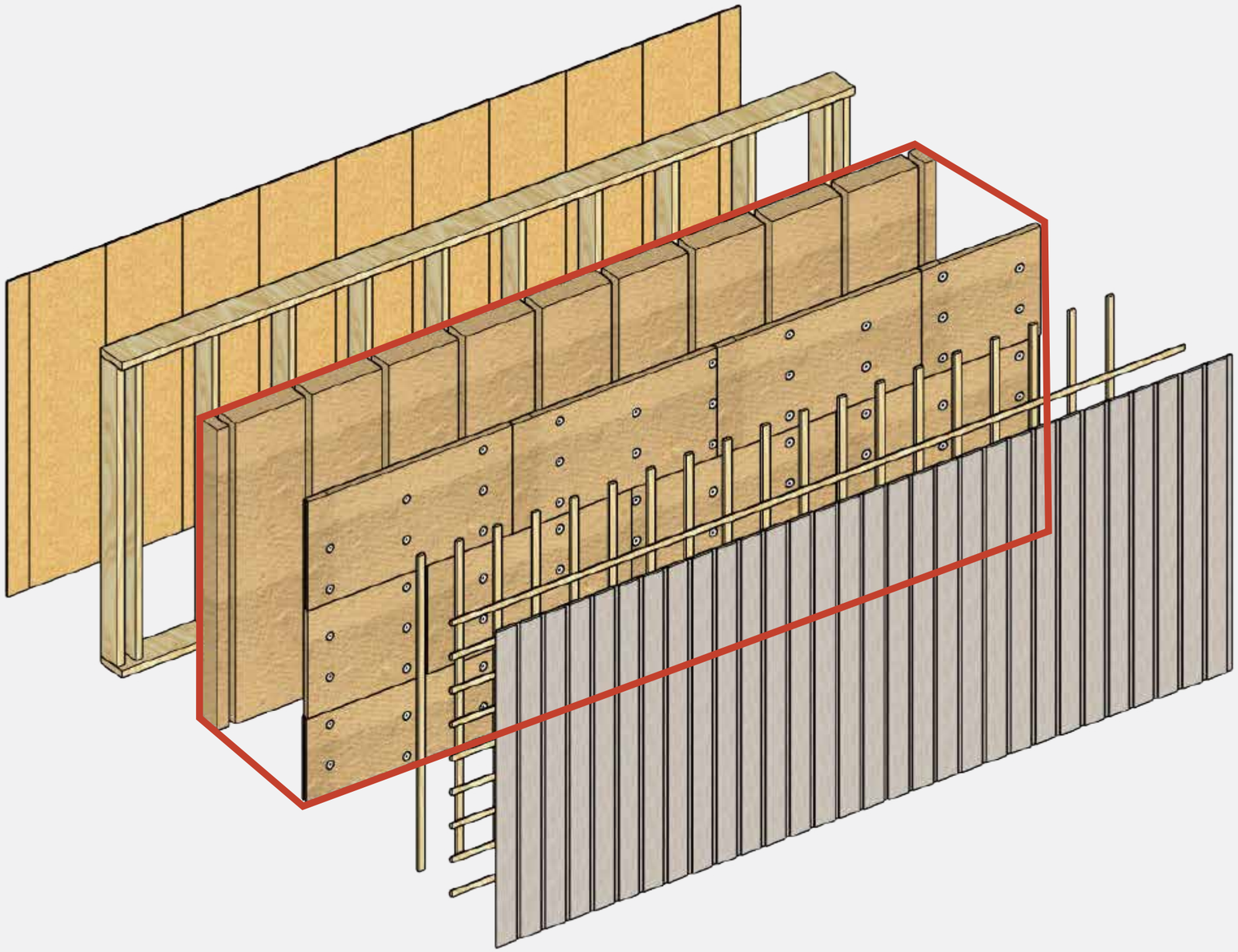
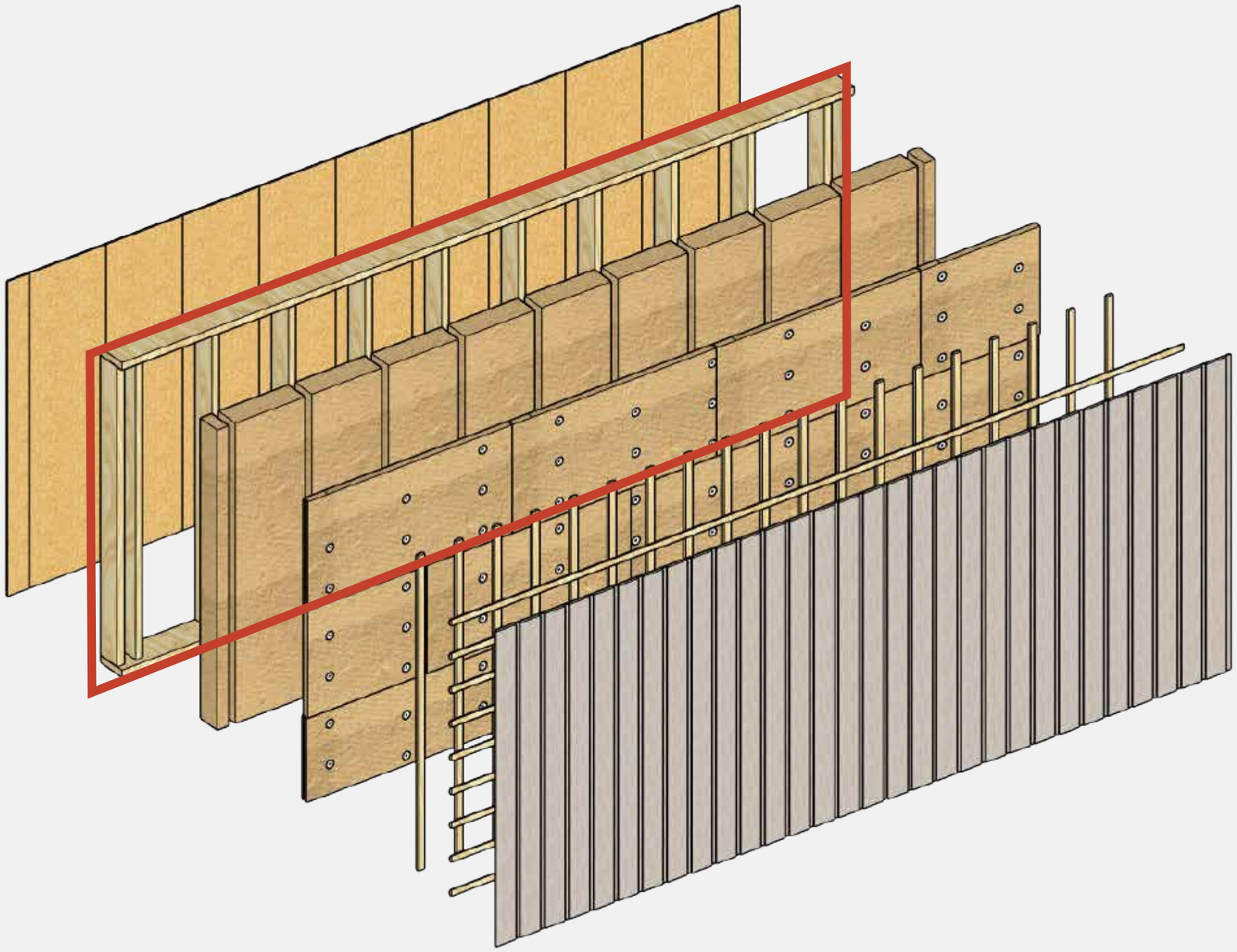
CO2 absorption & efficiency in energy use



Project

CO2 absorption & efficiency in energy use



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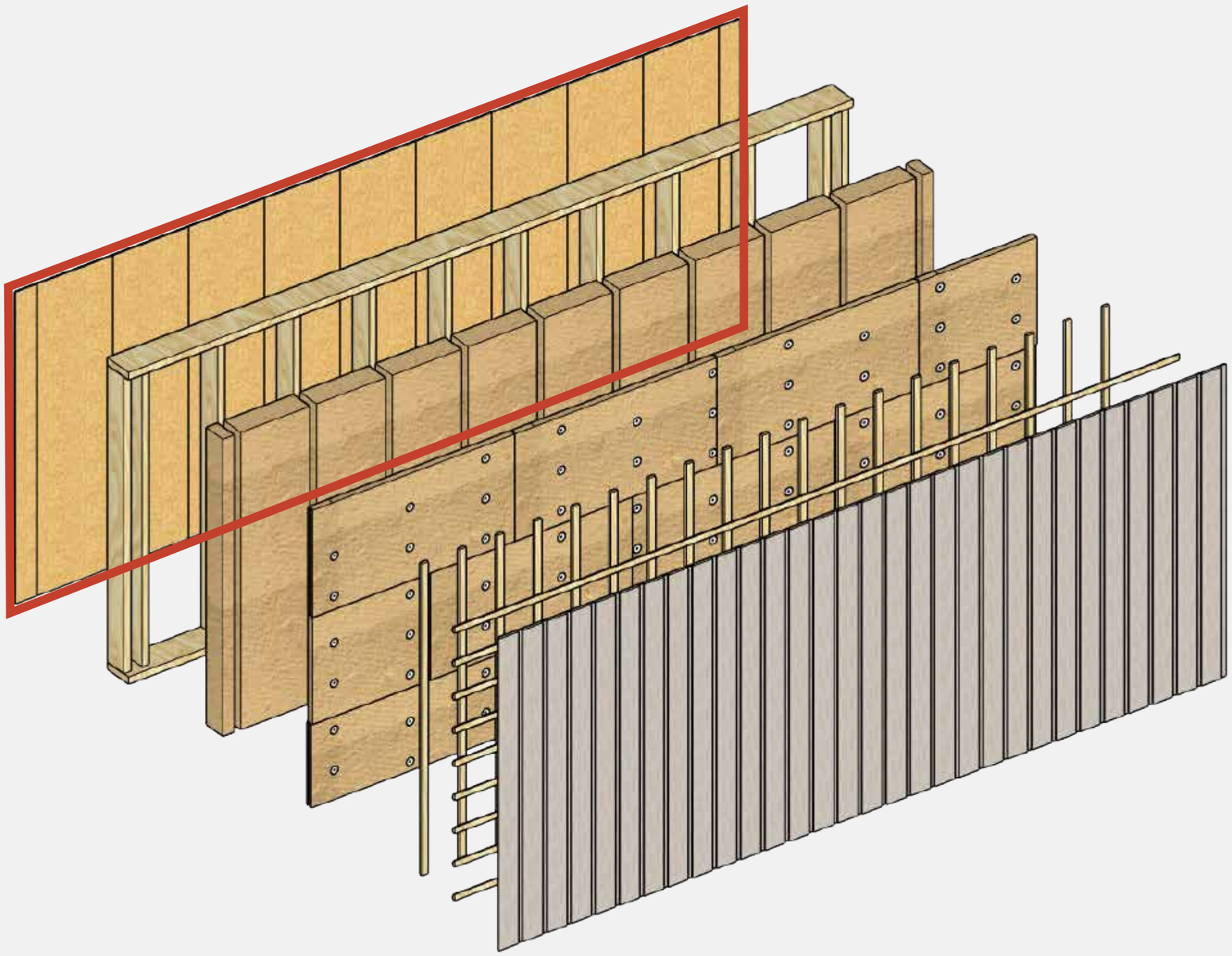
CO2 absorption & efficiency in energy use



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CO2 absorption & efficiency in energy use

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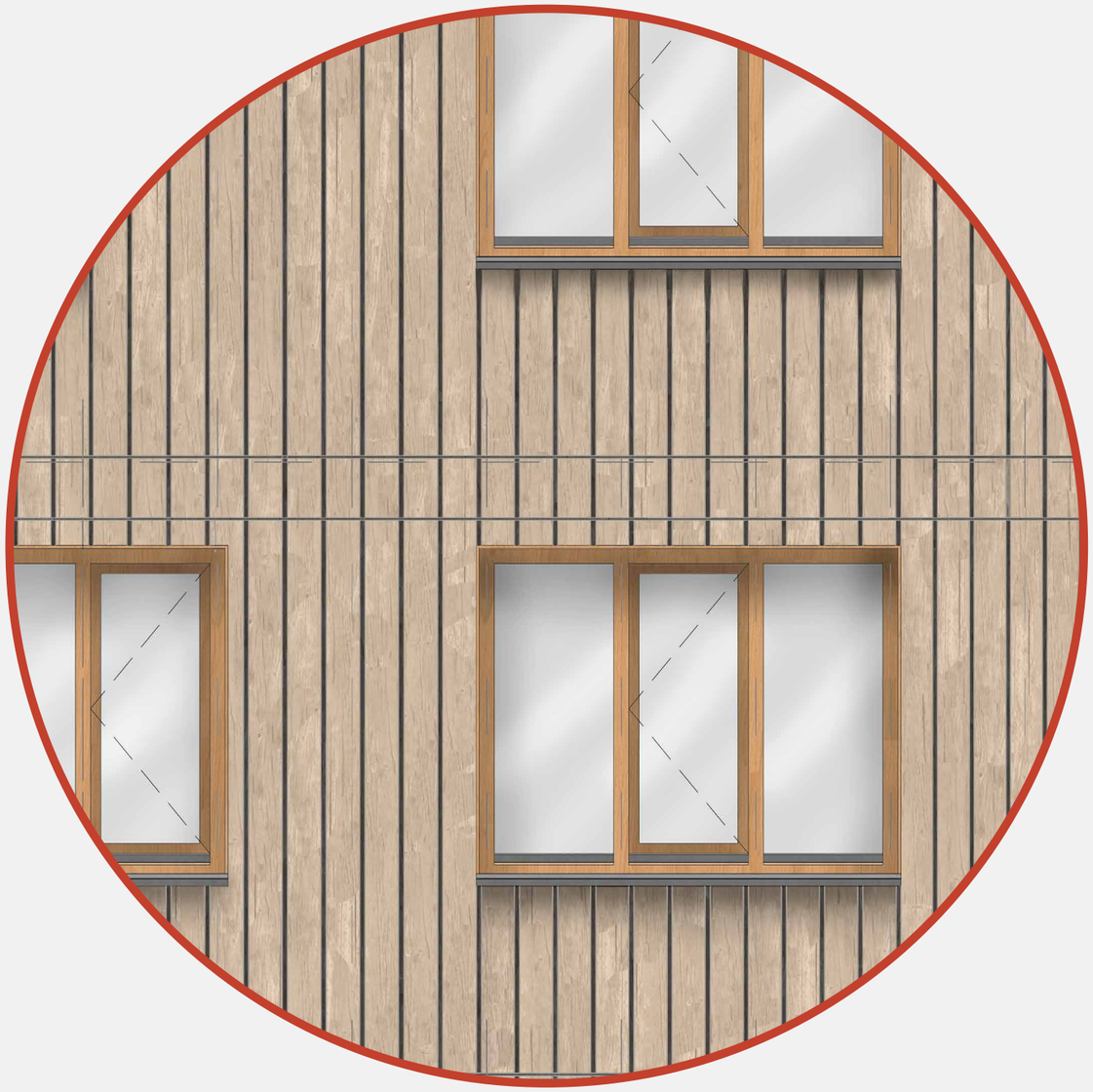
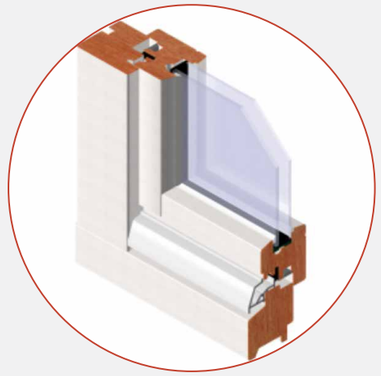
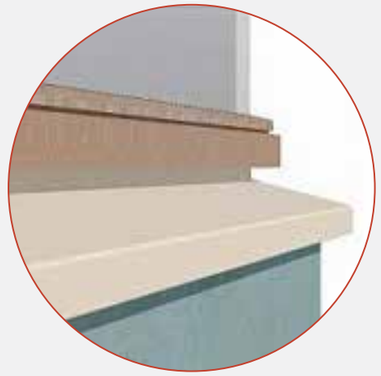
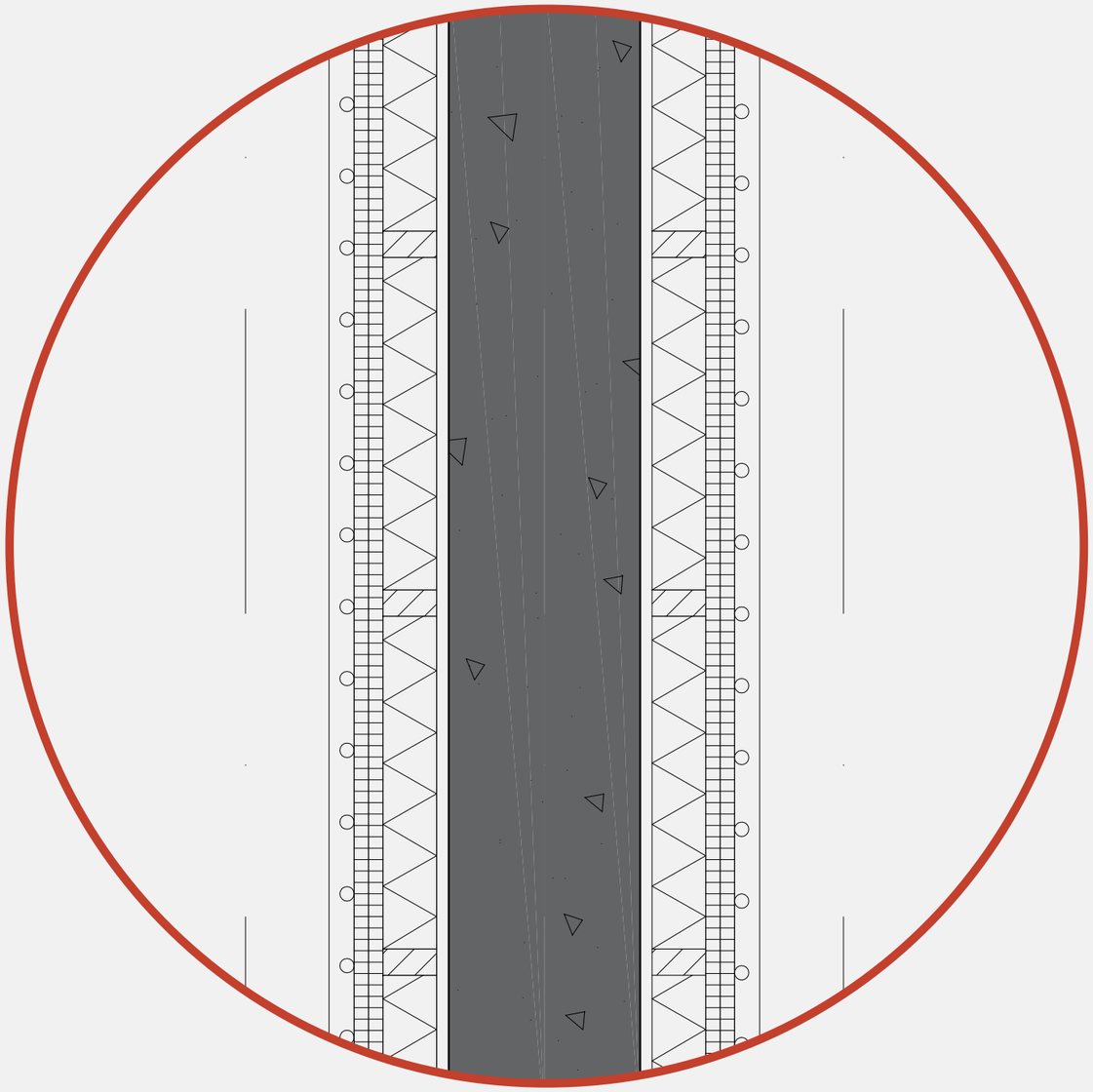


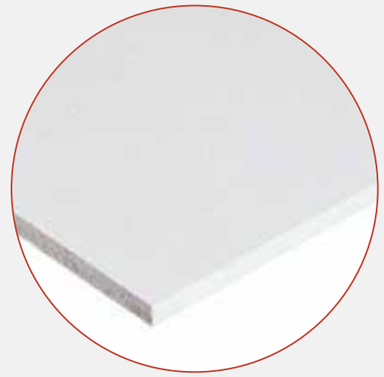


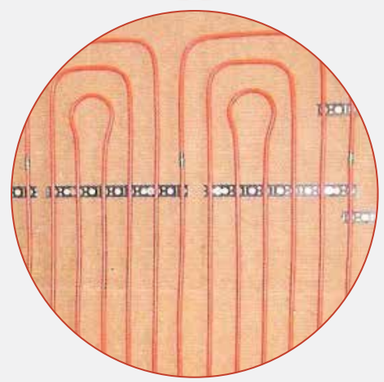


Project

CO2 absorption & efficiency in energy use

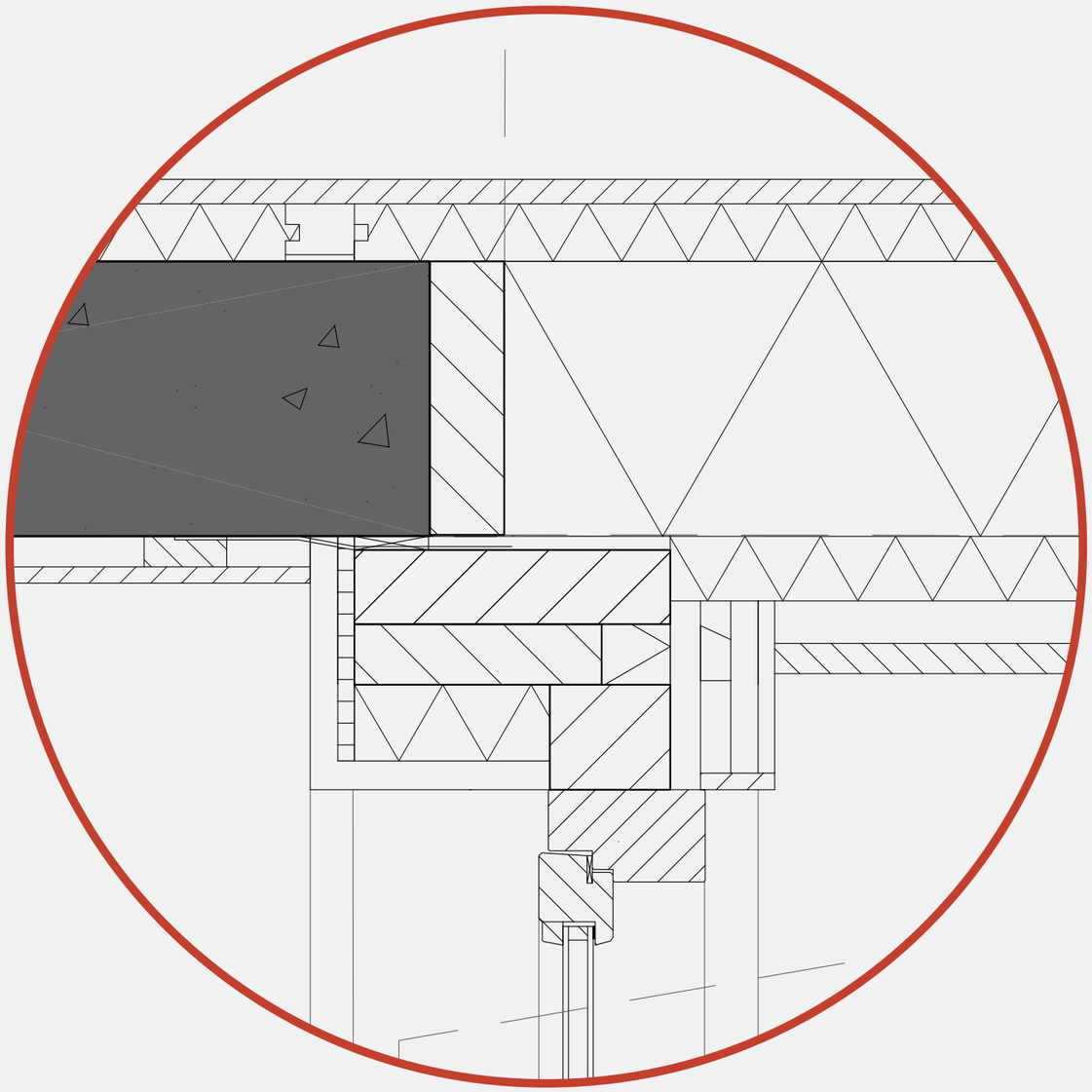






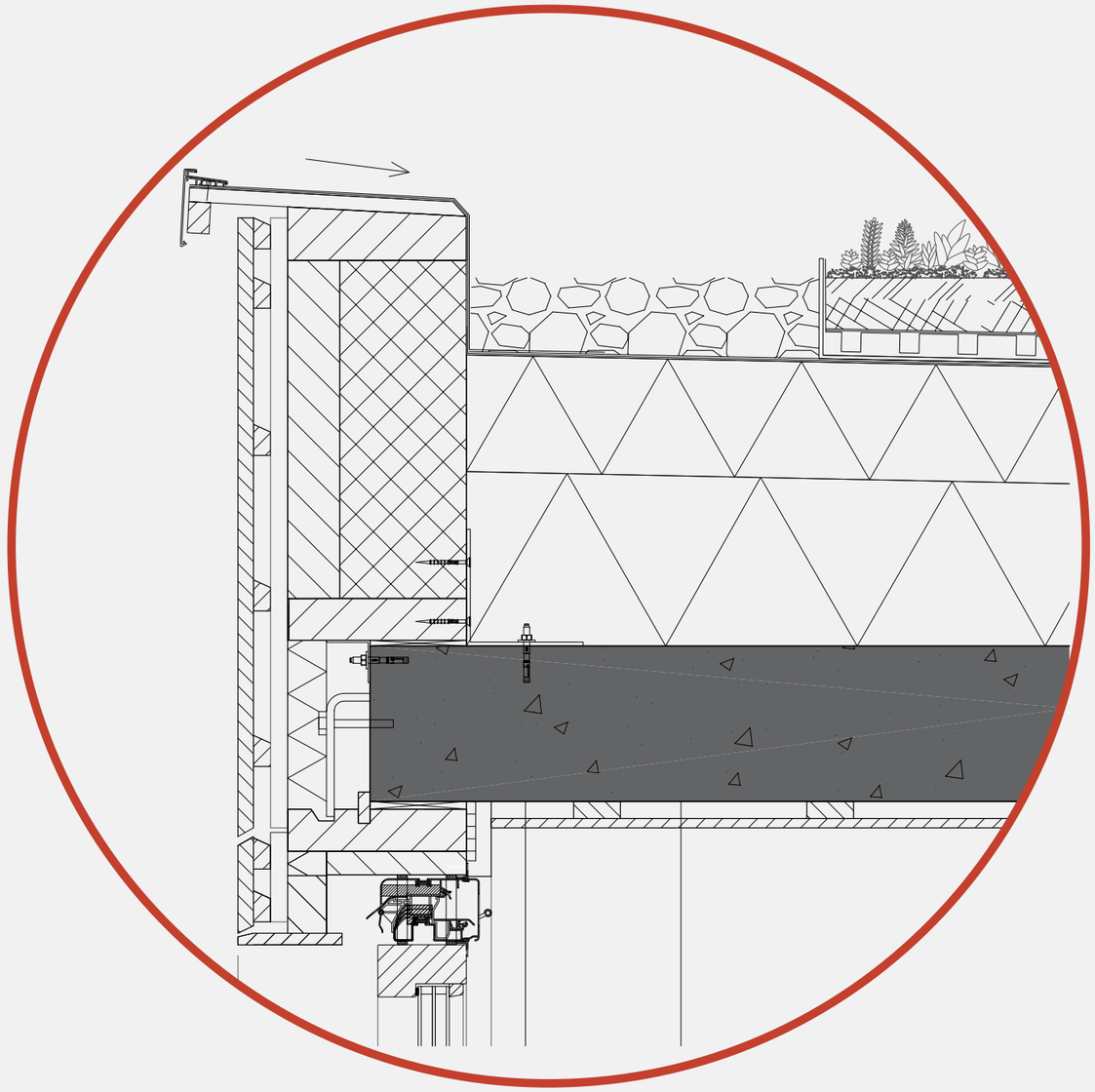
Project

CO2 absorption & efficiency in energy use



Project

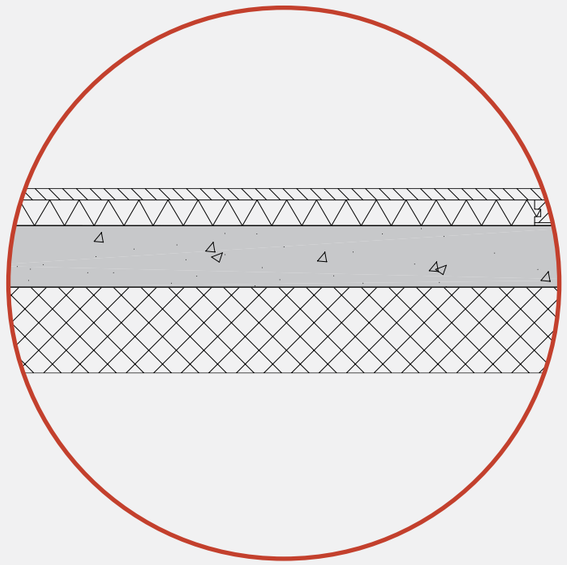
Materialisation and Structure



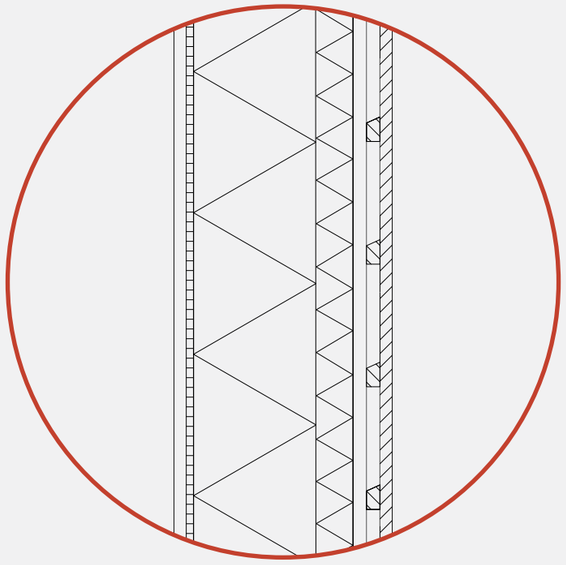
Conclusion

Conclusion

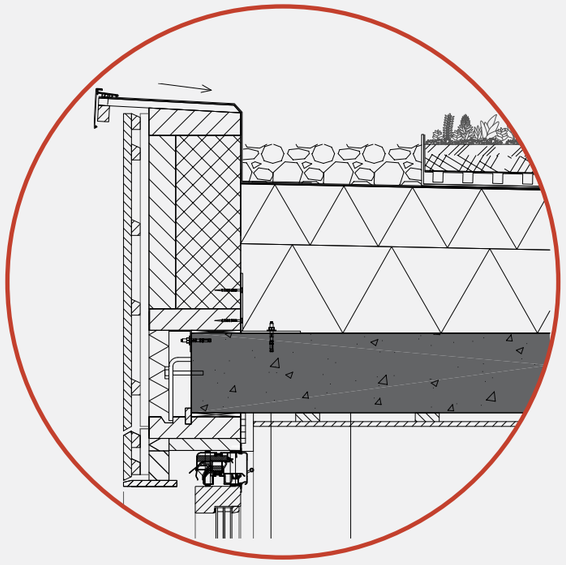
Energy neutral? U-values



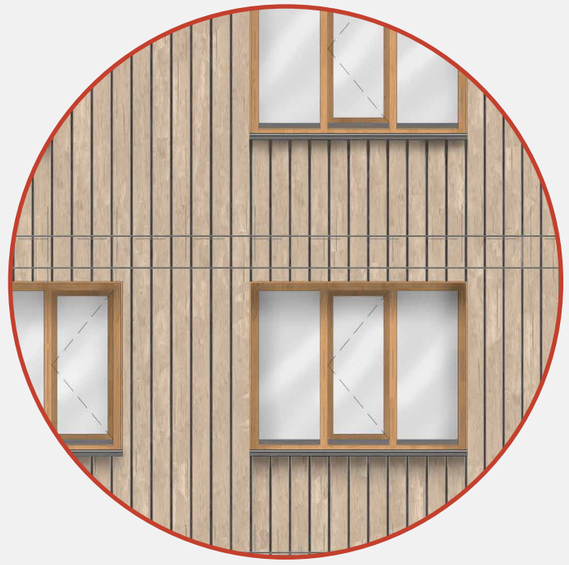
Floor: 0,177 W/m²K



Façade: 0,151 W/m²K



Roof: 0,117 W/m²K



Windows: 0,95 W/m²K

Conclusion

Energy neutral? EPC calculation

Uniec 2

House on corner	-0,117
House with small ground floor	-0,017
House with large ground floor	-0,174

Conclusion

CO2 neutral?

Materialen	C02 uitgifte	CO2 Opname	Totaal CO2
Insulation			
Wood fibre (Pavatex)	646,8	1211,1	
Glass wool (Isover)	238,61		
Timber			
Pine (Grenen)	44,1	425,7	
Accoya (treated)	106,6	1029,4	
European Oak	340,5	3288,3	
Plywood	558,6	2440,6	
Larch	344,5	3326,9	
Board material			
OSB	138,2	603,7	
Gypsum fibreboard	5700,4		
Metalen			
Aluminium	1,7		
Stainless steel	287,8		
Plasters			
Gypsum plaster	16,8		
Lime plaster	2681,3		
Rest of			
Glass	791,2		
Bitumen	14,6		
Concrete	7,0		
TOTAAL	11918,6	12325,7	-407,1

Conclusion

CO2 neutral?

	CO2 (ton)
Total embodied carbon of materials	-325,6
Total transport to location	13,2
TOTAL	-312,4

Note: Carbon footprint of fabrication of the elements and on location is unknown

Thank you | Questions?