

NET-ZERO ENERGY REFURBISHMENT
WITH CIRCULAR BUILDING MATERIALS
AT THE TU DELFT

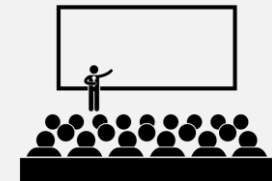
P5 - Iris Snijders Blok – 03-11-2017

Master Building Technology

THE POSED PROBLEM IS BOTH GLOBAL AND LOCAL

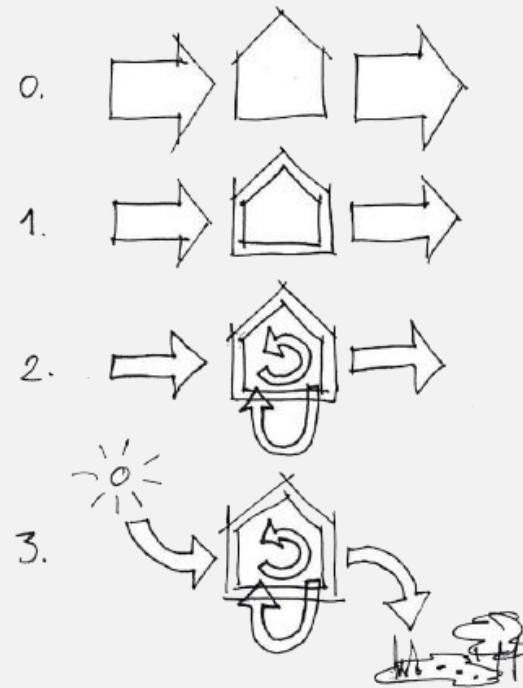
There are worldwide problems that are partially caused by the Built Environment.

- Worldwide problems, including:
 - Global warming
 - Depletion of natural resources
- Built Environment is a large contributor,
 - because it consumes large amounts of energy and materials
- Focus on refurbishment,
 - because there are far more existing buildings than new builds
- TU Delft is a good starting point,
 - because the university own 62 buildings and aims to decrease the consumption



DECREASE THE CONSUMPTION OF ENERGY AND MATERIALS

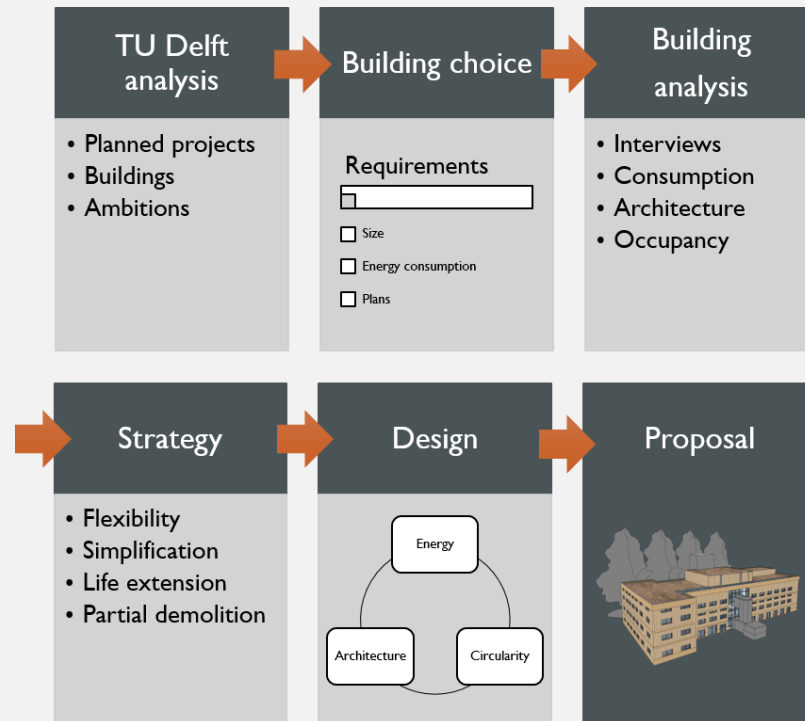
- Decrease
 - Energy consumption
 - Material consumption
- Increase
 - Reuse
 - Disassembly
 - Flexibility



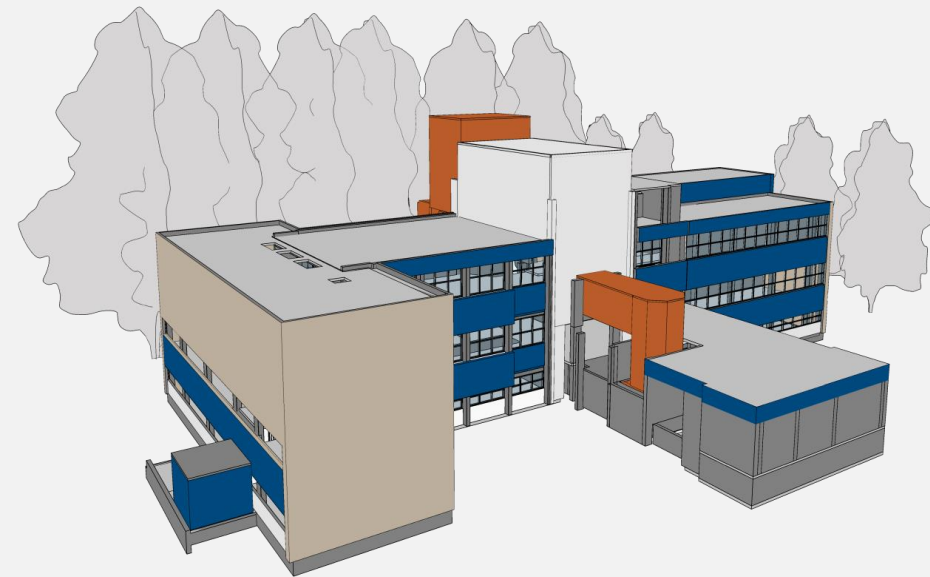
THE RESULT OF THIS GRADUATION IS A METHOD AND A BUILDING PROPOSAL

The graduation project result in an energy neutral refurbishment of the Low Speed Lab and provides the TU Delft with a method to refurbish its building portfolio

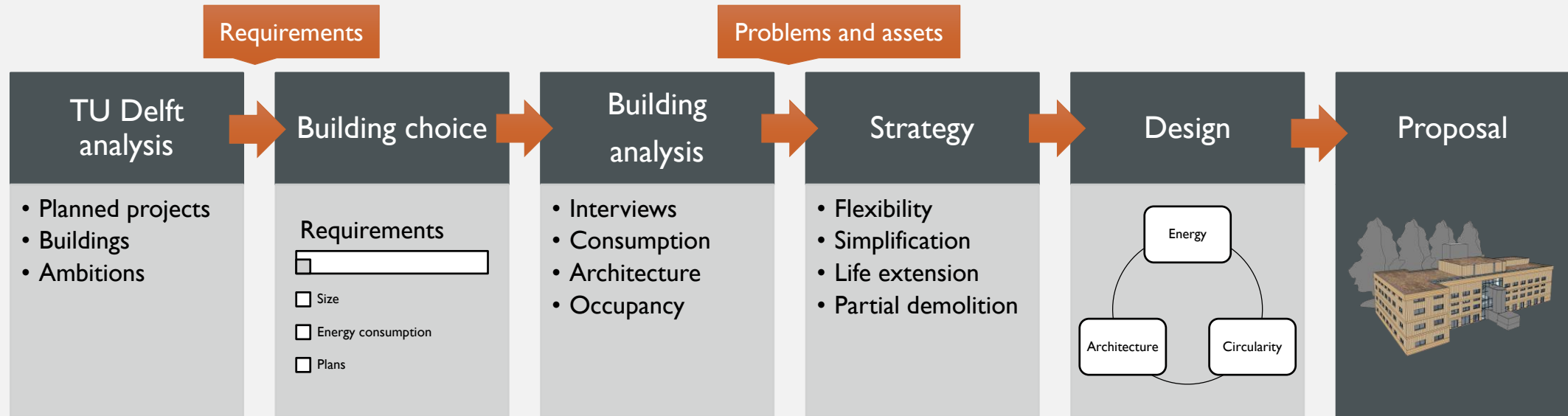
REFURBISHMENT METHOD



REFURBISHMENT PROPOSAL



METHOD



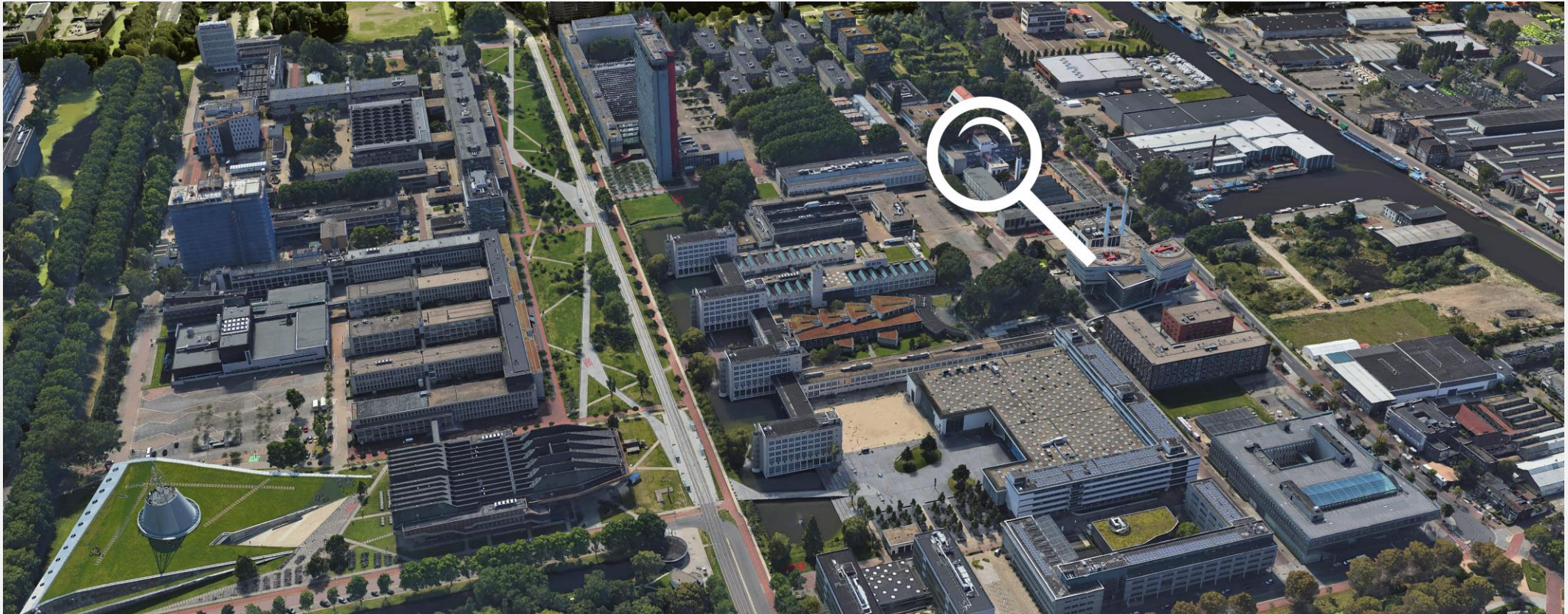
THE LOW SPEED LAB IS LOCATED AT THE PERIMETER OF THE CAMPUS

Overview of mid-section of the campus



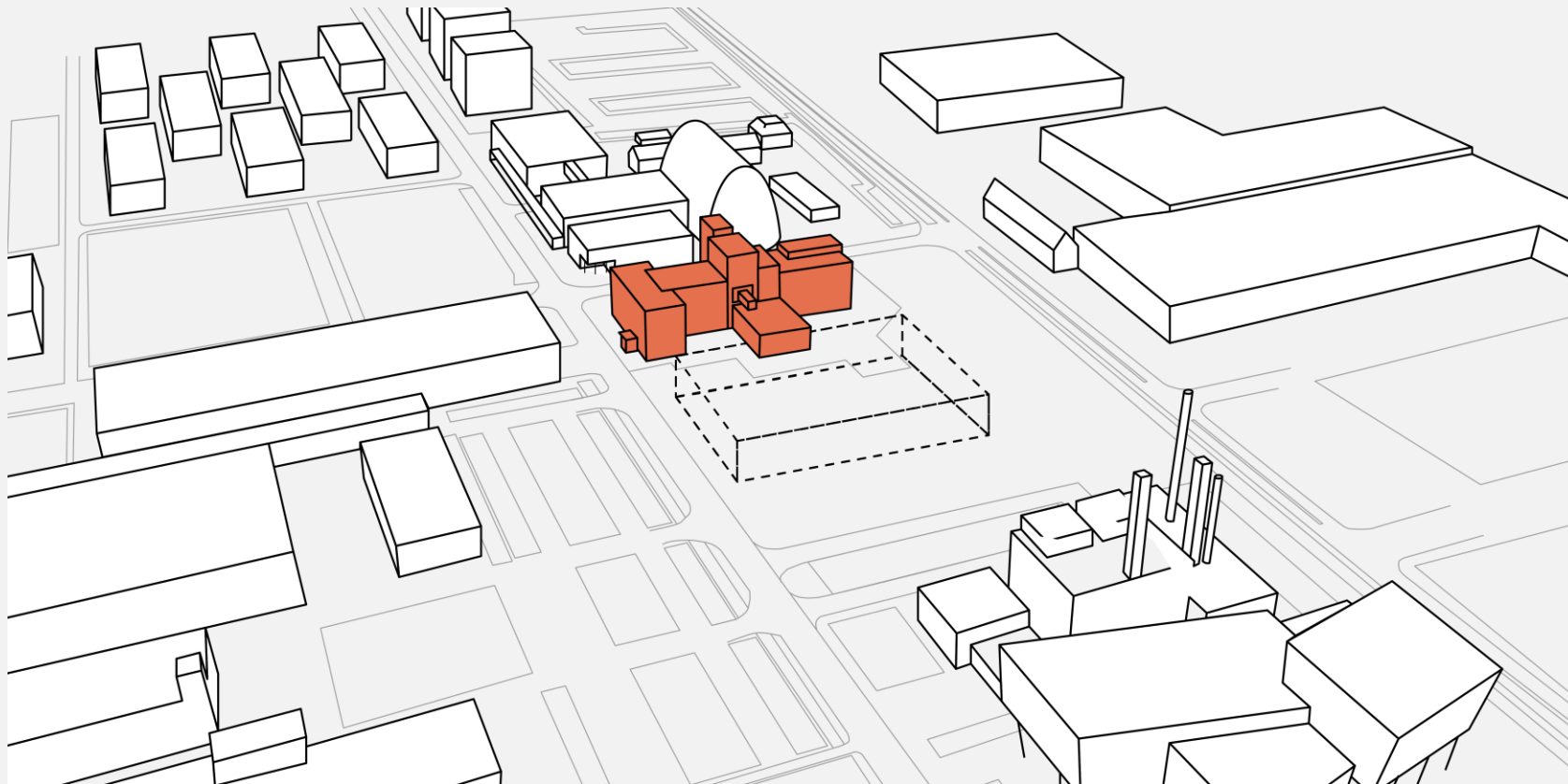
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THE LOW SPEED LAB IS LOCATED AT THE PERIMETER OF THE CAMPUS

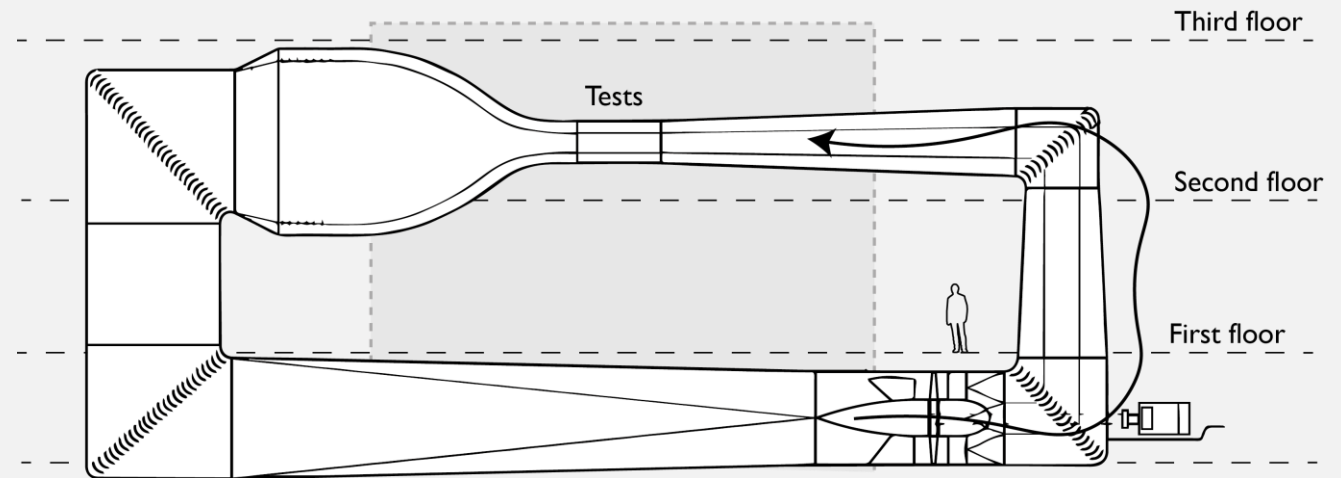
Location of the Low Speed Lab at the campus of TU Delft



THE BUILDING HOUSES A THREE-STOREY HIGH WIND TUNNEL

Key information on the chosen building

- Low Speed Low Velocity wind tunnel
 - Built in 1952. Addition in 1977
- Increase of users groups to nine
 - Morphology does not suit many users
- High energy consumption
 - Lack of thermal insulation
 - Many machines
- Area is being redeveloped
 - New parking garage
 - New park



Section of the Low Speed Low Velocity wind tunnel

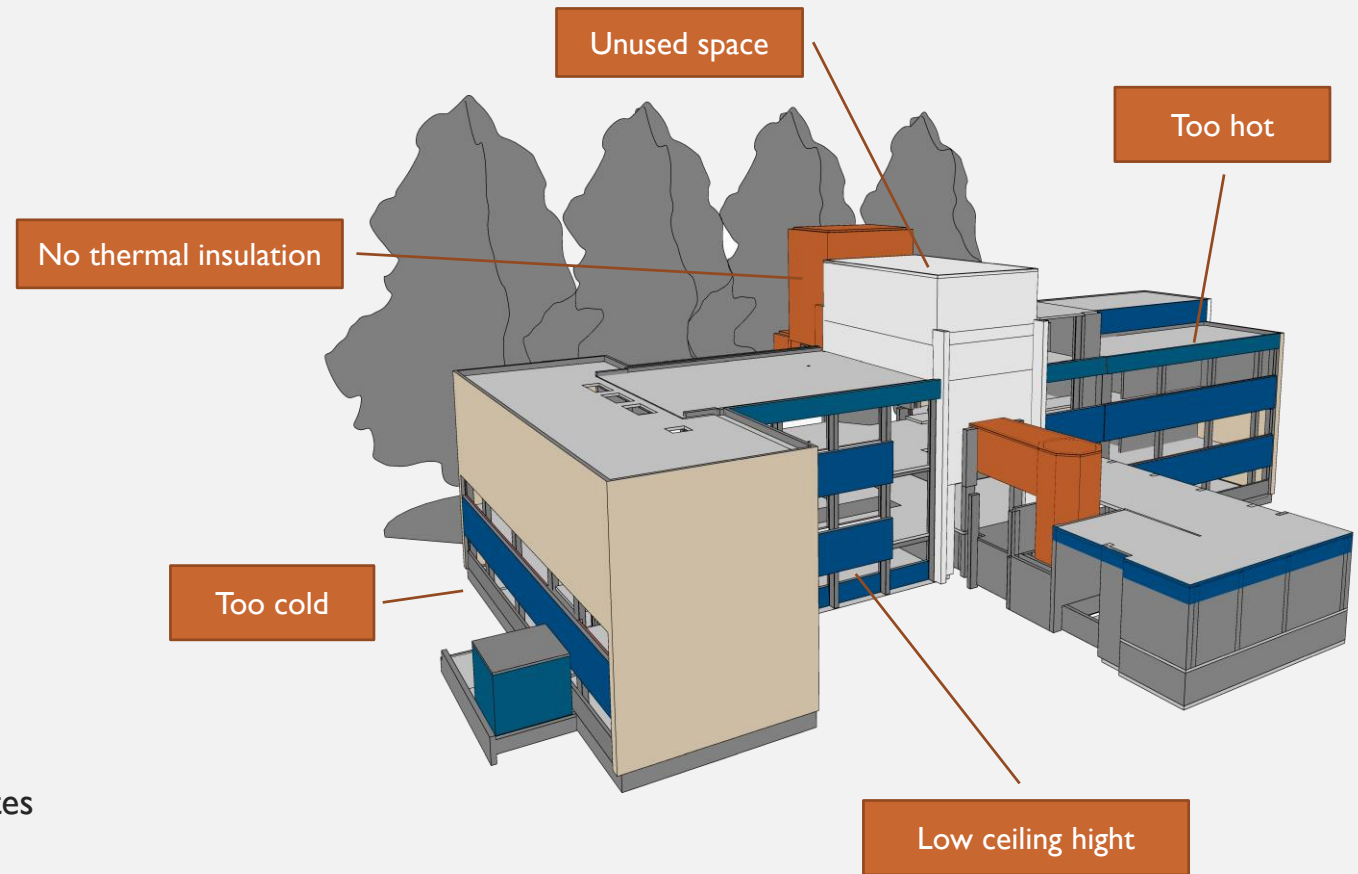
PROBLEMS

1. Comfort

- Too cold/warm
- Lack of thermal insulation
- Lack of daylight

2. Morphology

- Defect routing
- Dead end routes
- Chaotic
- No focus point
- Many materials, volumes, colours and routes



ASSETS

1. Structure

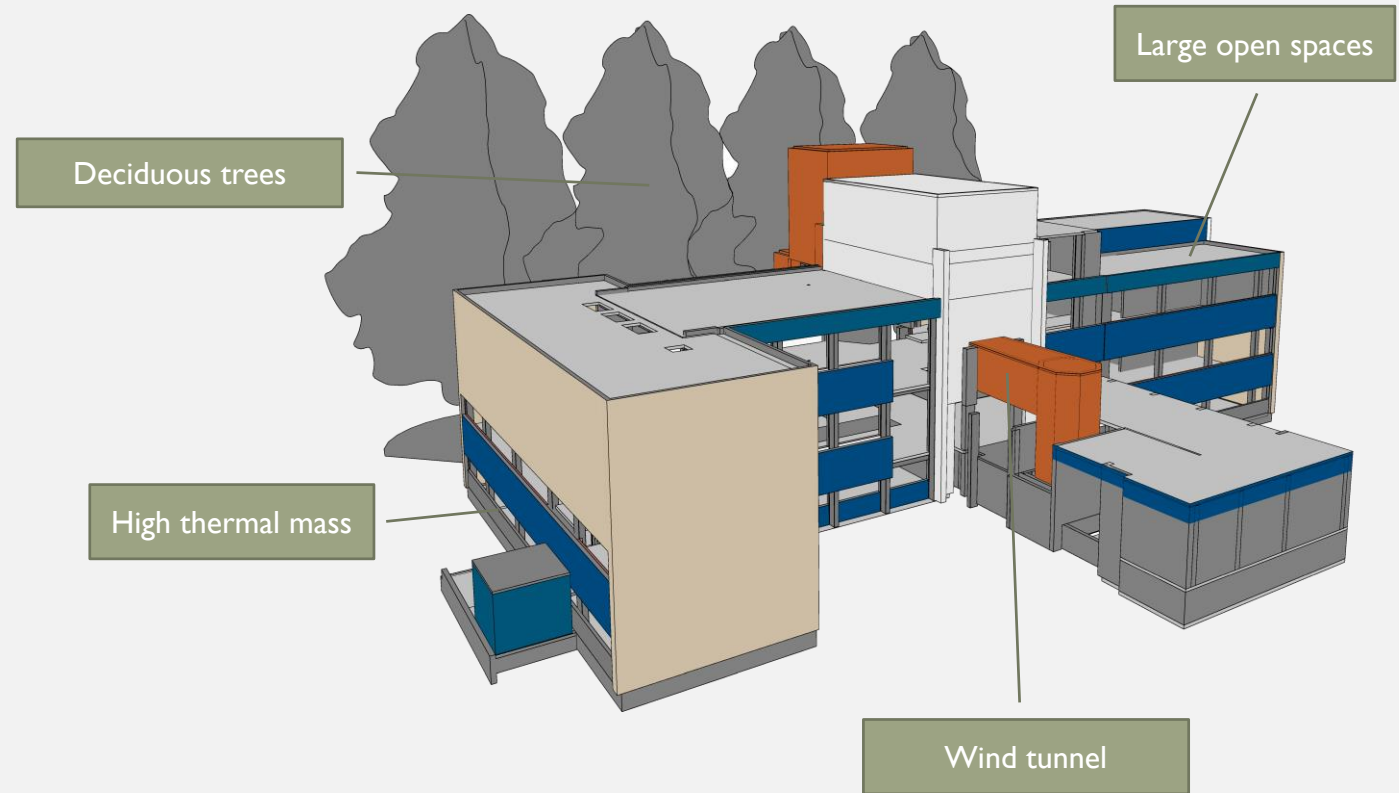
- Large open spaces
- High floors

2. Architecture

- Wind tunnel
- Open spaces

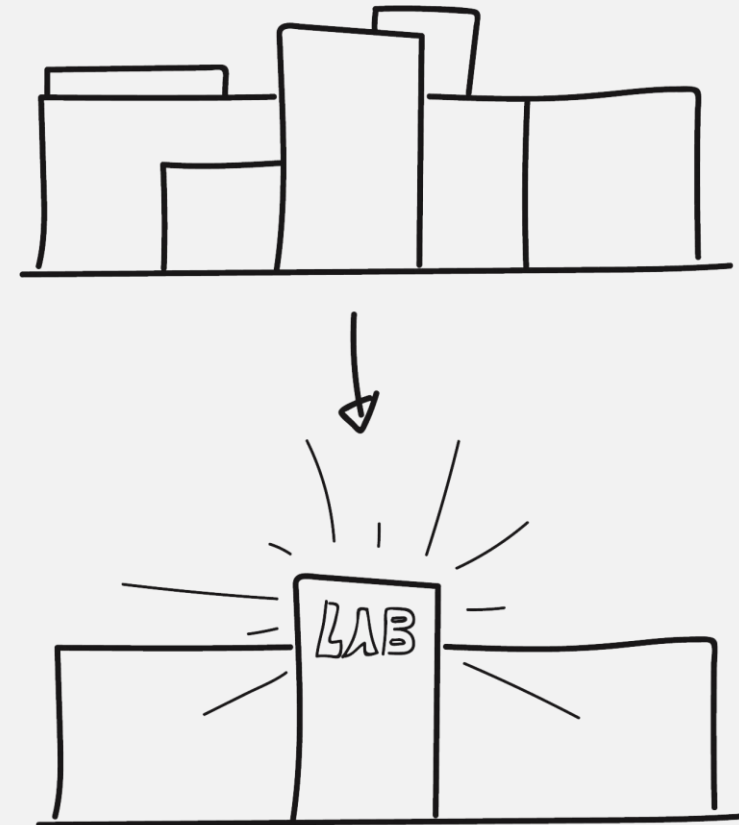
3. Climate

- High thermal mass
- Deciduous trees

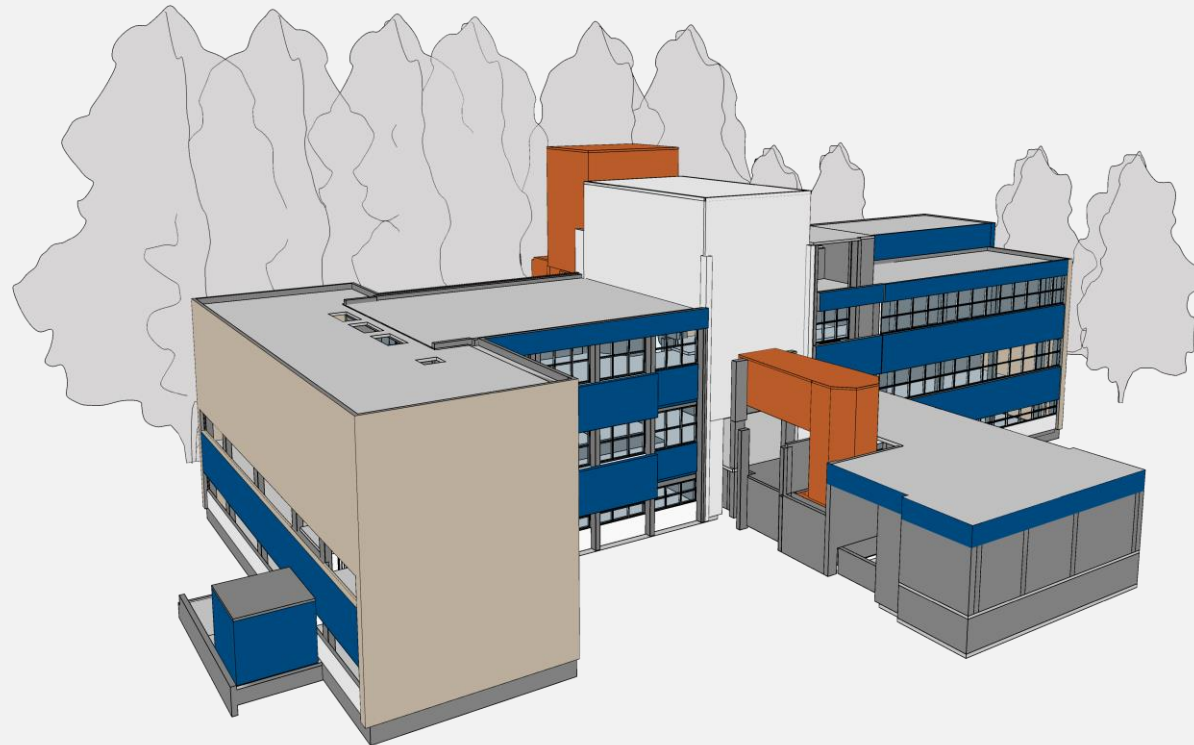


STRATEGY

1. Simplify
 1. to decrease the current chaos
2. Decrease consumption and increase reuse
 1. of both materials and energy
3. Increase flexibility
 1. to make a future-proof building that can accommodate changes (e.g. users, functions)
4. Strengthen relationship with urban context

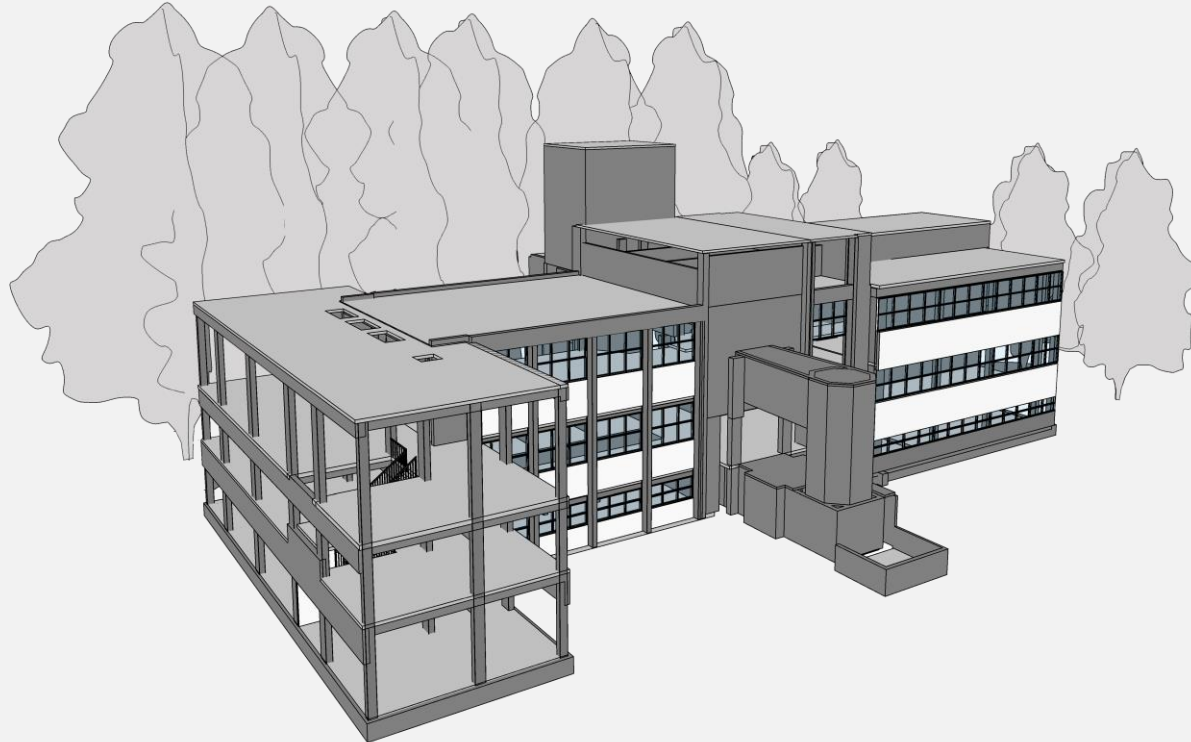


0. CURRENT BUILDING



Current volume (14000 m³)

I. STRIPPED



Demolition of (uninsulated) machine hall (1110 m³)

Demolition of (uninsulated) top floor (338 m³)

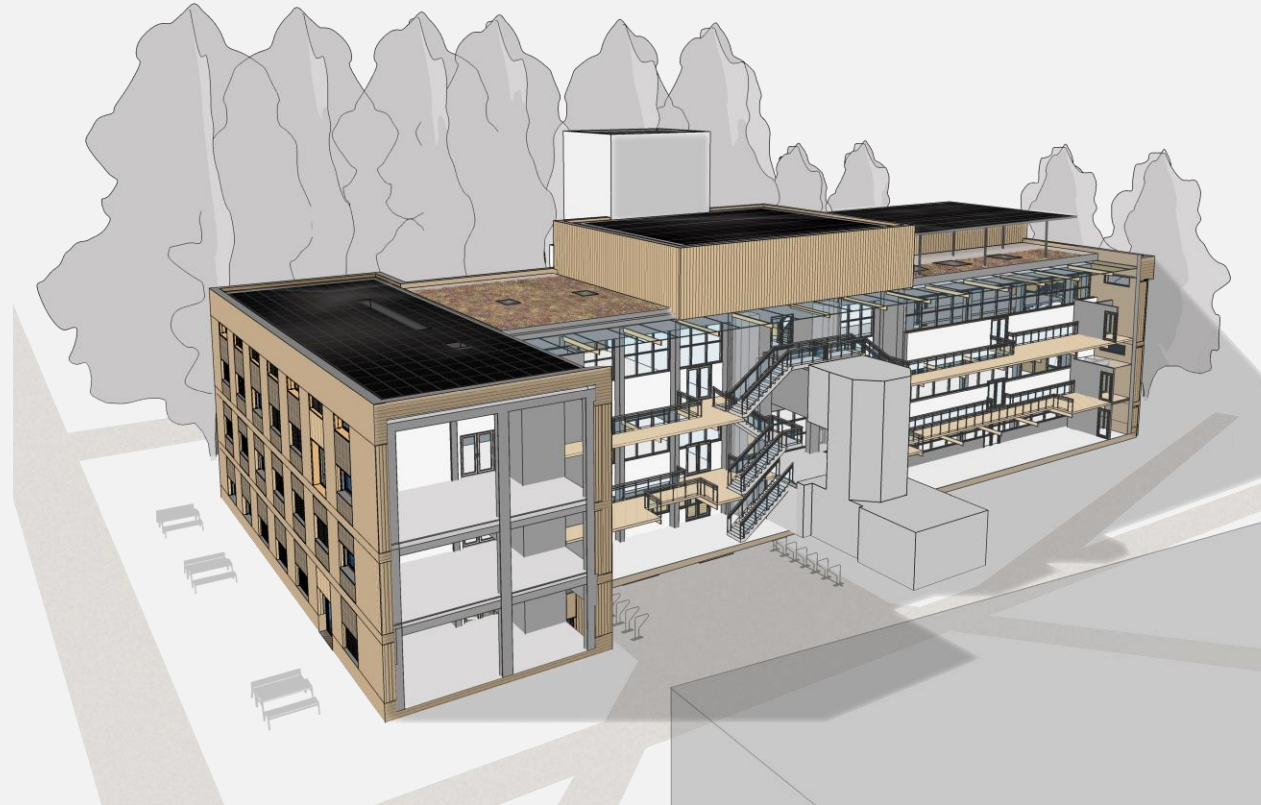
2. NEW DESIGN

The new design consists of an add-on and a new facade

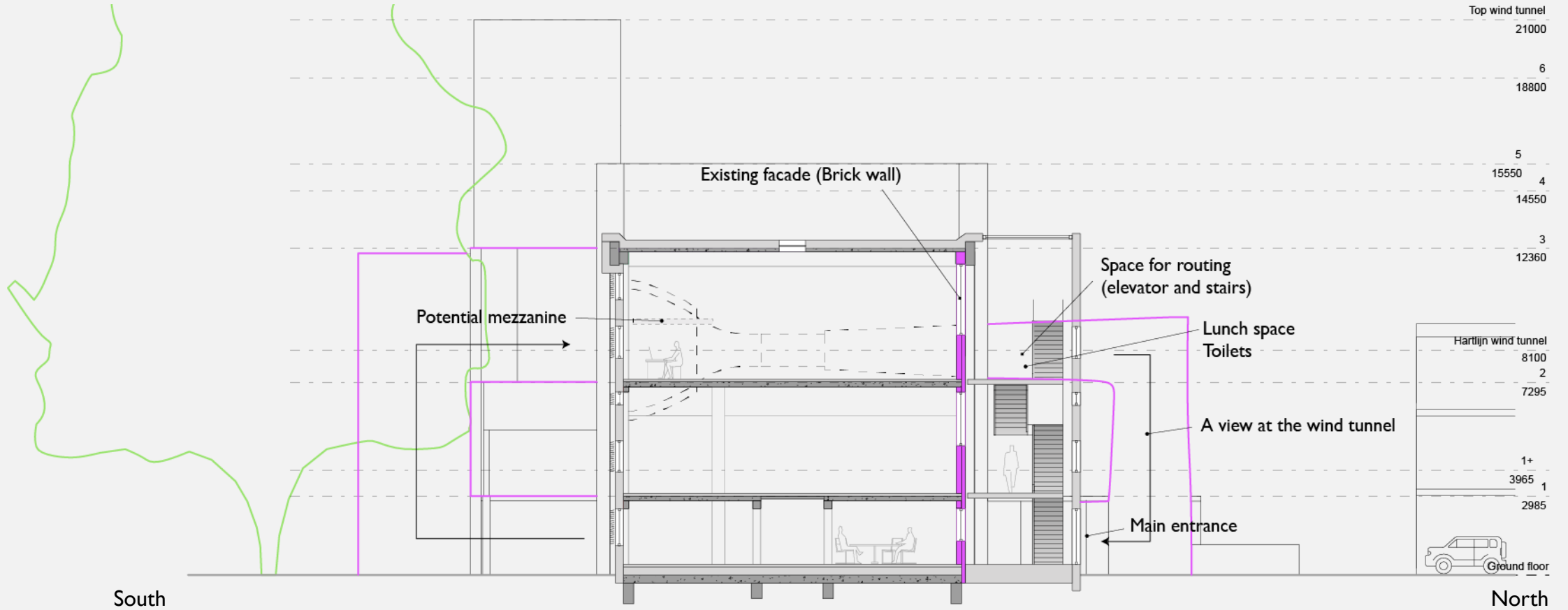


Addition of 4,5 m wide volume (2740 m³)
Total (15302 m³)

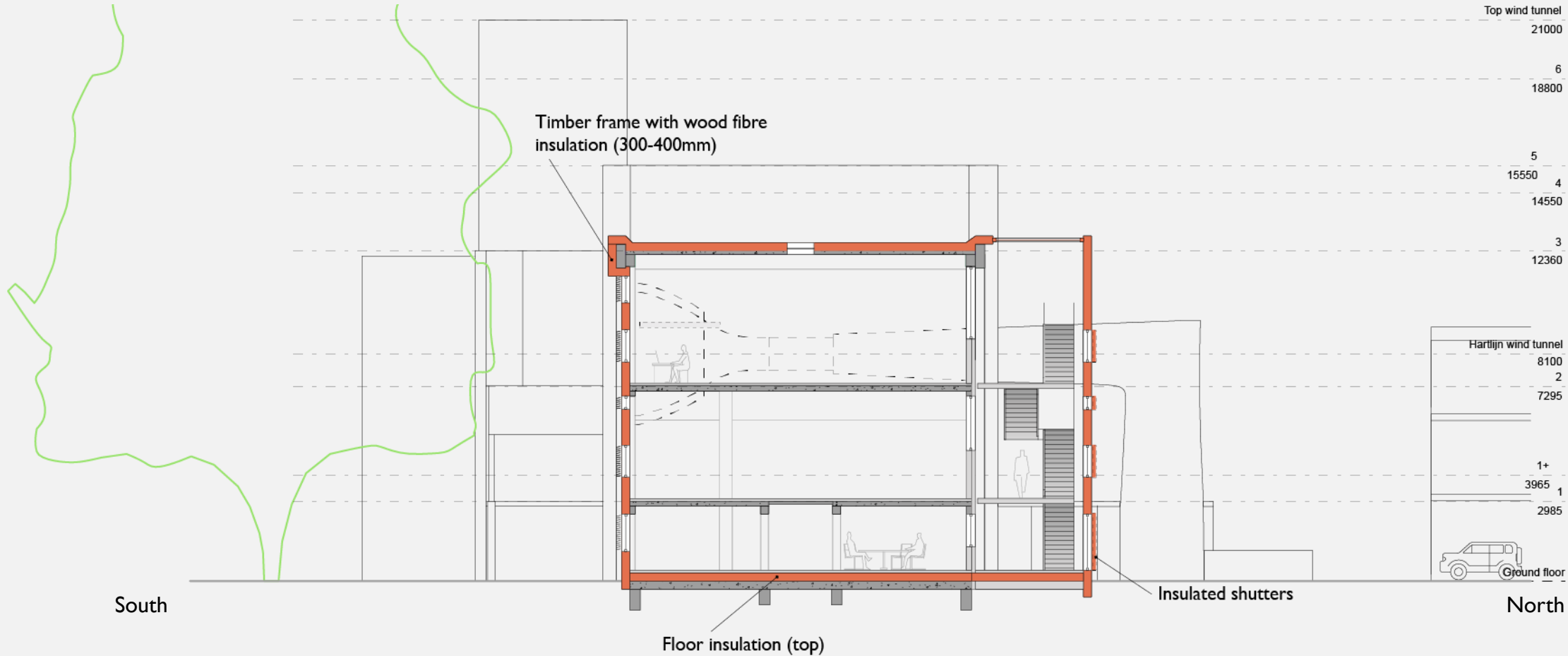
THE FLEXIBILITY IS IMPROVED BY DIVIDING THE BUILDING IN FOUR



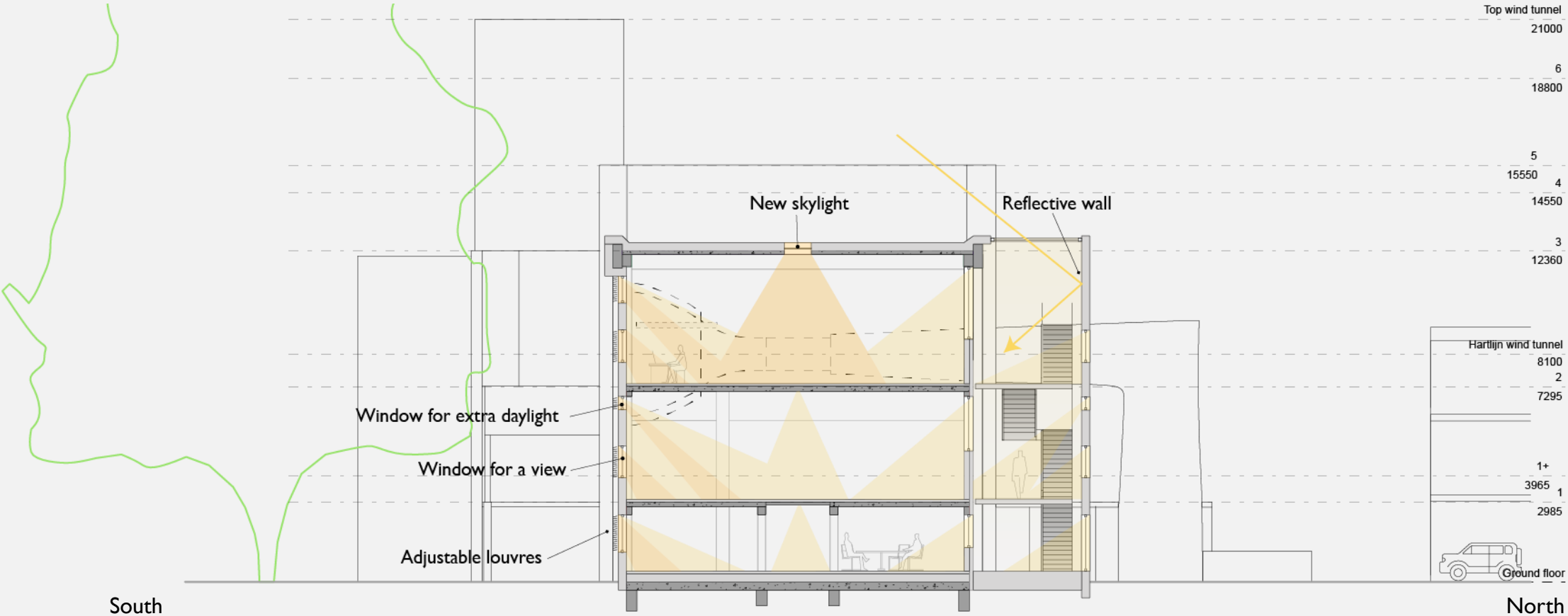
ARCHITECTURE



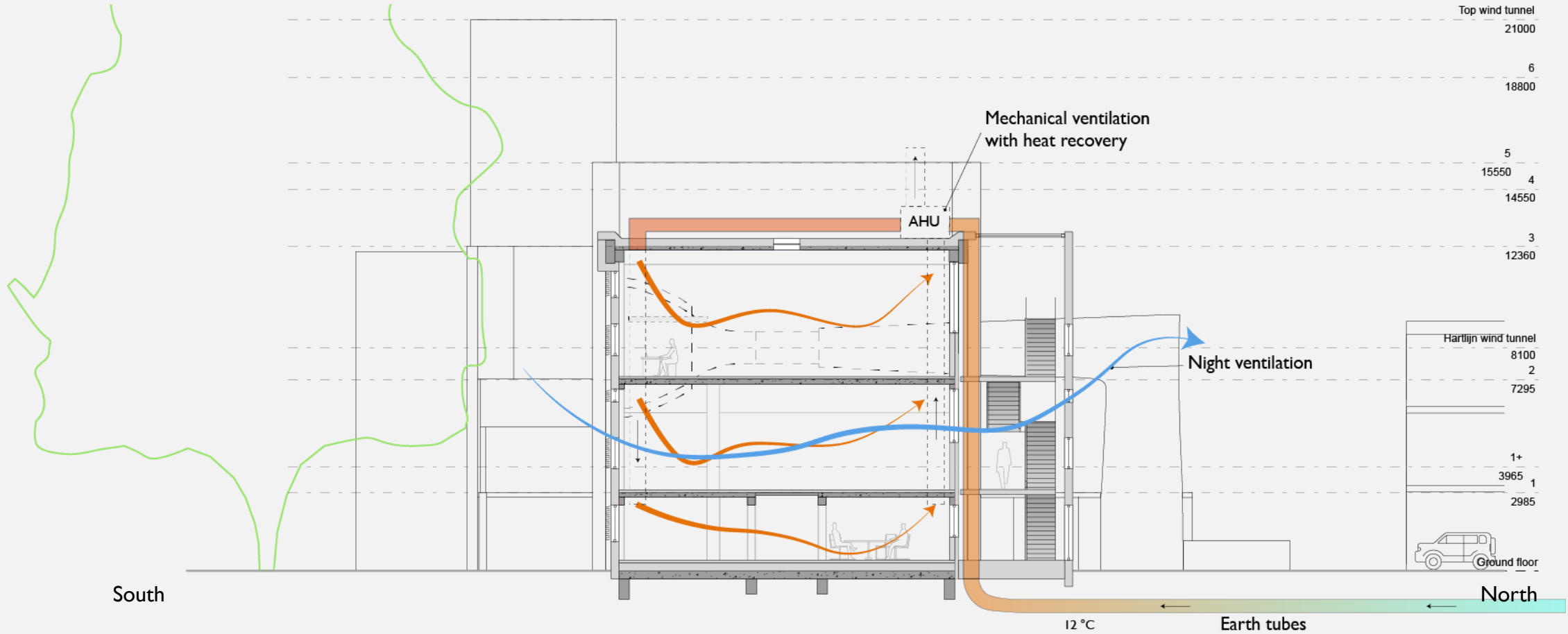
FACADE



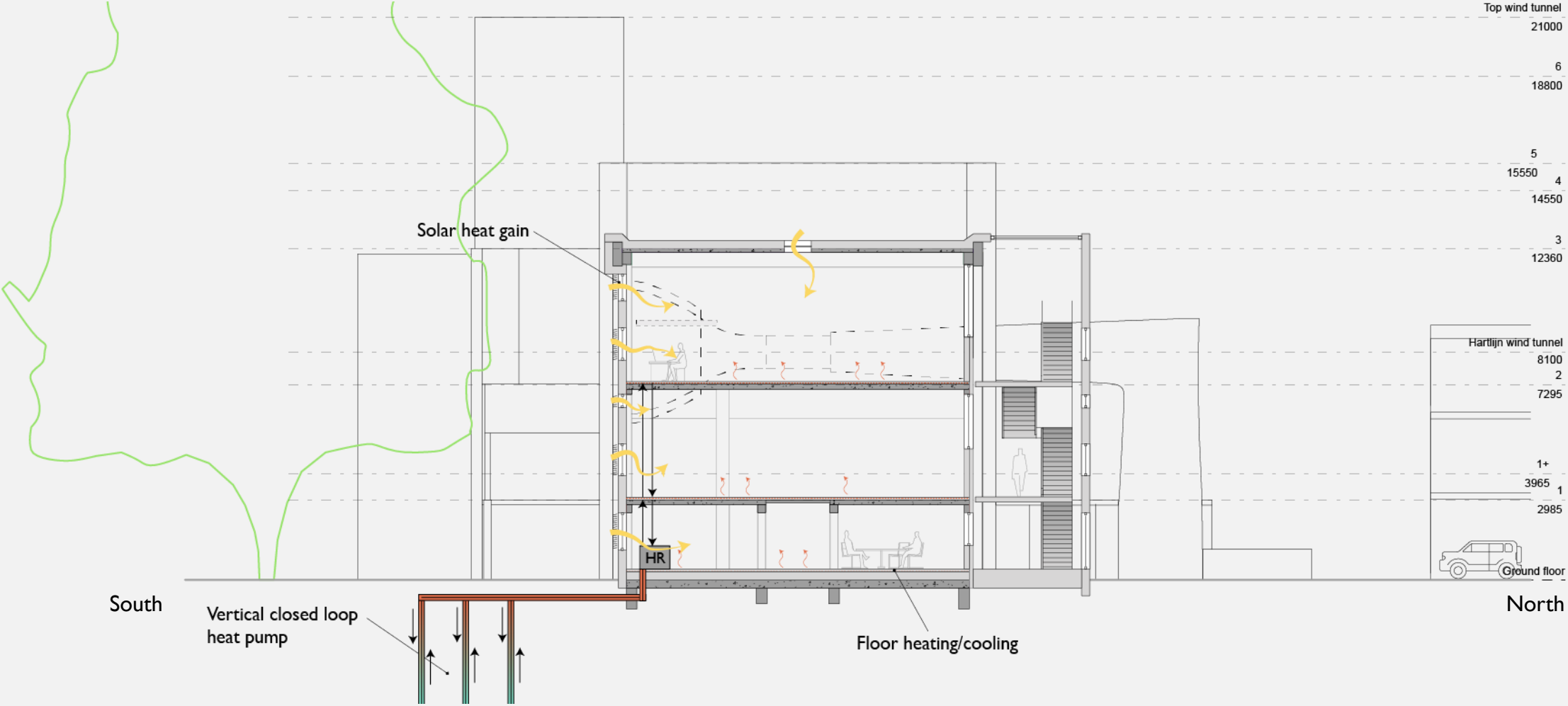
DAYLIGHT



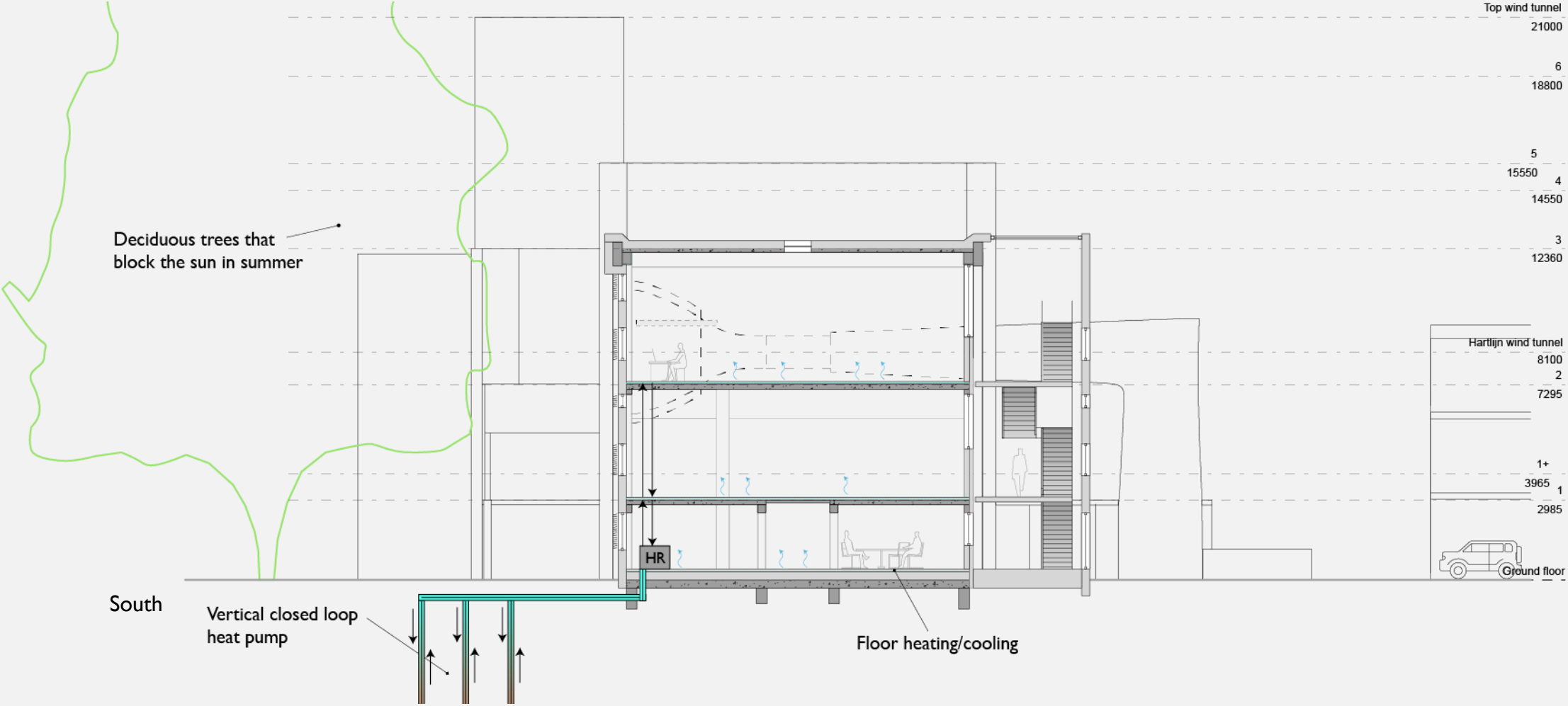
VENTILATION



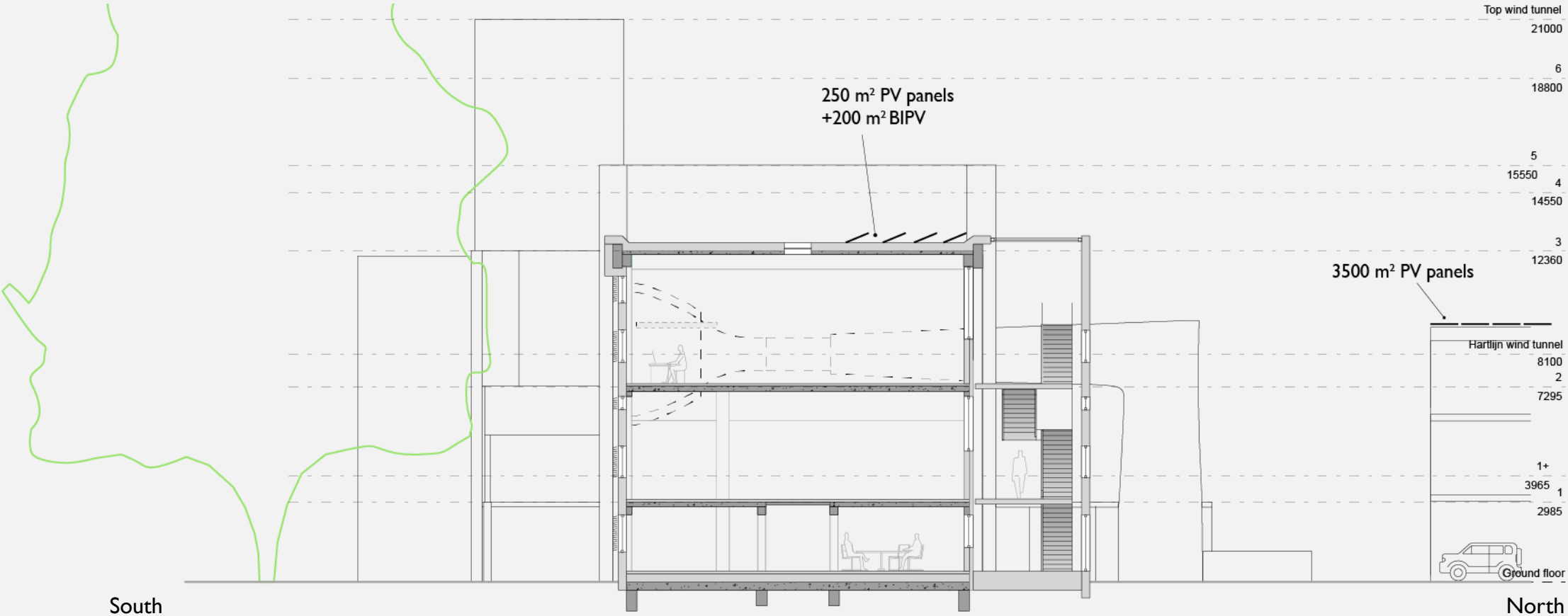
HEATING



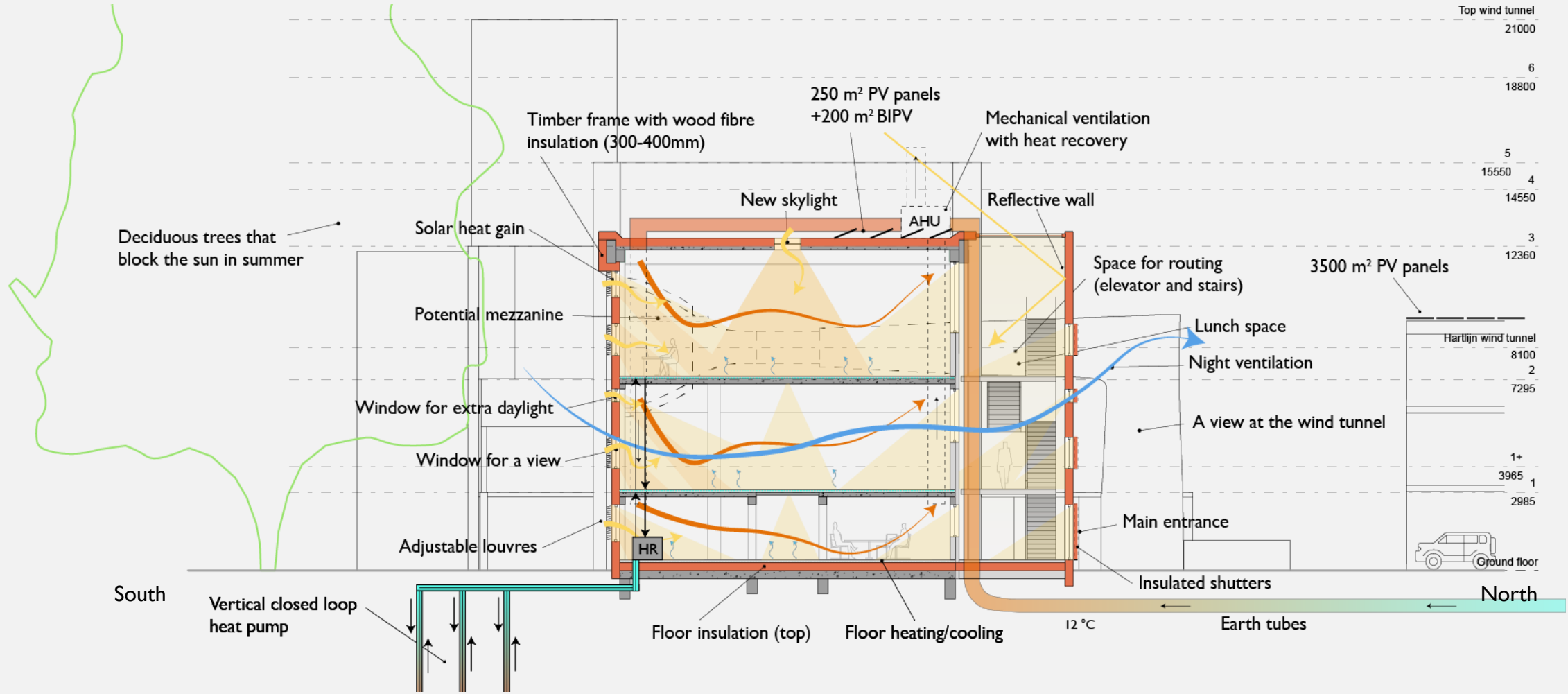
COOLING



ELECTRICITY GENERATION



TOTAL SCHEME

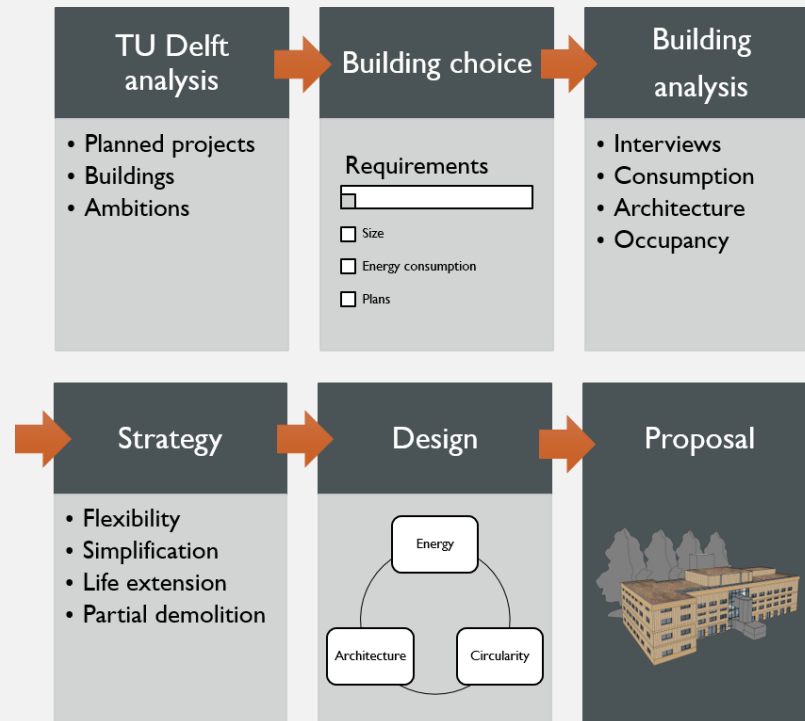


RESEARCH QUESTION

What technical (re)design solutions should be used in the refurbishment of a TU Delft building to achieve net-zero energy whilst taking circular use of building materials into consideration?

RESULT AND CONCLUSION

REFURBISHMENT METHOD



REFURBISHMENT PROPOSAL



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