

Hochschule Düsseldorf - University of Applied Sciences at Solar Decathlon Europe 21: Team MIMO develops innovative building design

Düsseldorf, 03/12/2020

Team MIMO of *Hochschule Düsseldorf - University of Applied Sciences (HSD)* develops an innovative building design for an addition and renovation of Café Ada in Wuppertal's district Mirke for the *Solar Decathlon Europe 21*.

The *Solar Decathlon* is the biggest, international competition in energy-efficient, ecological building designs and will take place in Germany for the first time. After Madrid and Versailles, the finals of *SDE21* come to Wuppertal in summer 2022.

18 international university teams compete in ten disciplines and present their designs for an innovative, sustainable and energy-efficient building project.

Students, staff and professors from the faculties of Architecture, Design, Electrical Engineering & Information Technology, Mechanical & Process Engineering, Social Sciences & Cultural Studies and Business Studies of *HSD* are united under the umbrella of *In-LUST – Institute for Sustainable Urban Development* and develop a solution for resource-efficient buildings under the guiding principle of 'MINIMAL IMPACT - MAXIMUM OUTPUT', aka MIMO.

«We are currently feeling very clearly how sensitive our planet is. But also, how grateful for any protection.», says Lena Hille, team member in Team MIMO, about the motivation to participate in *SDE21*. «We see sustainable and circular building as an indispensable turning point in architecture.»

Therefore, team MIMO is focusing on sustainable urban densification considering a noticeable added value for the residents. In times of worldwide increasing 'urbanization' and progressing climate change, the *SDE21* faces the teams with truly existing challenges of energetic urban redevelopment: closing gaps, additions of storeys and renovations. Specific subject of team MIMO is the cautious renovation and addition of storeys of an existing warehouse in Wuppertal from 1905 which is used as catering, dance and event location by the supra-regional known *Café Ada*. The planned ecological renovation and addition with an energetically optimized residential use shall strengthen the district in a sustainable way while being further densified and become a central venue of communication. According to the team's motto, it shall always be done what brings added value to the place and creates maximum output with minimal impact.

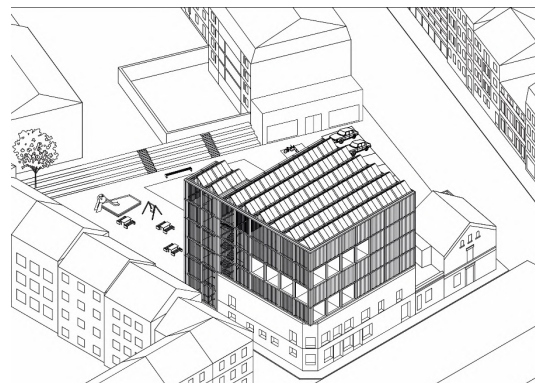


Figure 1 and Figure 2: visualization and isometry of storey-addition to the cultural centre Café Ada

Under a climate shell, which enables natural ventilation in every season and with solar power systems producing enough electricity for all usages underneath, 15 residential modules in wooden construction will be created for one to four persons. The innovative central power supply system *energiBUS* links a heat pump for heat and cold supply with household appliances and ensures energy efficiency in the whole system.

The design concentrates on the promotion of the community: Open and jointly used living or working areas and a roof terrace support the communal life. The public garden invites to joint 'urban gardening' for residents and neighbours.

Besides architectural, procedural and technical challenges, the team is confronted with informing people in the district about energetic and ecological subjects, fascinating and enabling them to become part in the urban energy transformation themselves.

«Important as it may be to develop a building that uses the most up-to-date energy-efficient technologies», says Professor Eike Musall, head of team MIMO, «it is also as crucial to consider the environment and the needs of the potential users of the building. According to the principle of 'only build, if we use it to improve the location', our project should offer added value to the immediate surroundings and contribute to the sustainable development of the city district.»

The finals of the student competition take place in June 2022 on the 'Utopiastadt-Campus' at Wuppertal's Nordbahntrasse. Besides the presentation of the planning design for the addition and renovation, a completely operative 1:1 demonstrator of the concept will be presented to the public. Team MIMO creates its own representative section in the size of 100sqm in a modular approach. Following the competition, the demonstrator of HSD will be part of the *Living Lab NRW* and occupied under real circumstances for a few years as well as scientifically and interdisciplinarily evaluated.



Figure 3: Team-Photo

Key words: Solar Decathlon Europe 21, HSD, Team MIMO, MIMO, Minimal Impact - Maximum Output, Wuppertal, Mirke, Café Ada, House Demonstration Unit, interdisciplinary, storey-addition, modular building, renewable energies, wood construction

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List of Team Members

Title	First Name	Surname	Degree	University course/Research field
Faculty Advisor	Eike	Musall	Prof. Dr.	Faculty of Architecture - Building Performance
Project Manager	Lukas	Horstmann	M.A.	Faculty of Architecture - Architect
Project Architect	Dennis	Mueller	Prof.	Faculty of Architecture - Building Construction and Design
Project Engineer	Mario	Adam	Prof. Dr.	Faculty of Mechanical and Process Engineering
Structural Engineer	Christoph	Ackermann	Prof.	Faculty of Architecture
Electrical Engineer	Holger	Wrede	Prof. Dr.	Faculty of Electrical Engineering - Electric Power Engineering and Power Electronics
Student Team Leader	Elias	Hoffmann	B.A.	Faculty of Architecture
Health & Safety Team Coordinator	n/a			
Safety Officers	n/a			
Site Operations Coordinators	n/a			
Contest Captain	n/a			
Instrumentation Contact	n/a			
Communications Coordinator	Hendrik	Siems		Faculty of Design
Sponsorship Manager	Jennifer	Binzen	B.A.	Faculty of Architecture
Team Member	Peter	Andres	Prof.	Lighting
Team Member	Jana	Bauer		Architecture
Team Member	Carina	Bhatti	M.A.	Faculty of Social Sciences and Cultural Studies - methods of social work
Team Member	Max	Bierbach	B.A.	Urban Mobility
Team Member	Jil	Bösl	M.A.	Communication
Team Member	Maximilian	Brockerhoff		Architecture
Team Member	Sonja	Cieslinski		Architecture
Team Member	Marcella	Crespo		Affordability & Viability
Team Member	Chiara	Decher		Architecture
Team Member	Ina	Ehrhardt		Architecture
Team Member	Isabella	Emonds		Architecture
Team Member	Alban	Fangmeier		Architecture
Team Member	Katrin	Fartaczek		Architecture
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Team Member	Mira	Hill		
Team Member	Lena	Hille	B.A.	Architecture

Team Member	Marvin	Hillebrand		Communication
Team Member	Georgina	Hogrefe		Architecture
Team Member	Jana	Holländer		Affordability & Viability
Team Member	Sabrina	Holz		Architecture
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Team Member	Alex	Kinzel	B.A.	Architecture
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Team Member	Anabel	Kurz		Architecture
Team Member	Jörg	Leeser	Prof.	Faculty of Achitecture - Urban Context Design and Urban Design Theory
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Team Member	Moritz	Munkel		Architecture
Team Member	Stephanie	Muscat-Bruhn		Communication
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Team Member	Judith	Reitz	Prof.	Architecture
Team Member	Maximilian	Rödder	M.Sc.	House Functioning
Team Member	Katja	Schiebler	Prof.	Lighting
Team Member	Janina	Schleuter	M.A.	Architecture
Team Member	Nina	Sohnemann		Architecture
Team Member	Matthias	Stemmer	B.A.	Architecture
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Team Member	Isabell	Szonn		Architecture
Team Member	Lisa	van Holt	B.A.	Communication
Team Member	Anne	van Rießen	Prof. Dr.	Affordability & Viability
Team Member	Shiwen Sven	Wang		Communication
Team Member	Andrea	Weiner		Architecture
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Team Member	Luise	Westphal		Architecture
Team Member	Cameron Juna	Wiest		Communication

Project Description

Team's Organisation and Objectives

Team MIMO of *Hochschule Düsseldorf - University of Applied Sciences (HSD)* is facing the competition and its new urban profile with the motto «Minimal Impact – Maximum Output». It means that implemented techniques and concepts have to add value to the location and create maximum benefit with minimal intervention. Specific subject of team MIMO is the cautious renovation and addition of storeys of an existing warehouse in Wuppertal Mirke from 1905 which is nowadays used as a catering, dance and event location by the supra-regional known Café Ada.

Six faculties and the *Institute for Sustainable Urban Development (In-LUST)* are involved in the interdisciplinary team. The team currently consists of 40 students and nine professors, supported by other professors, academic and student staff, the *HSD* workshop team and all further partners. Planning and ideas come together in the *Faculty of Architecture* where the concepts for Design Challenge and House Demonstration Unit (HDU) are developed and the subsequent construction is coordinated. Students from the *Faculty of Social Sciences and Cultural Studies* have analysed the clientele of the Mirke district and contribute their thoughts to the planning of the apartments. Members of the *Faculties of Mechanical and Process Engineering* as well as *Electrical Engineering and Information Technology* develop strategies for energy supply and load management. Supported by students of the newly added Faculty of Design, the team prepares the concepts and transfers them to public relations via its website as well as Facebook and Instagram.

Project Development and Current State

After a long phase of purely digital cooperation caused by the closure of the university in the course of the Corona Pandemic, a presence workshop was finally held again on the campus of the *HSD* in September 2020. Among the participants were students, employees and professors of team MIMO as well as representatives of some partner companies who were able to watch and discuss the presentations, partly on-site but also digitally.

The aim of the workshop was the concretisation of a final architectural and energy concept which, after analysis by small groups and team decision, now forms the basis for the competition entry and will be finalised with regard to the structural design and implementation planning of the demonstrator.

The three-day workshop was also used for a large distance team picture, sponsoring activities and public relations.

Design Challenge

Our main emphasis is on the new building's living areas providing communal space for encounters and social exchange between the inhabitants. By stacking 17 individual wooden modules on top of each other and spreading them in a way across three floors that due to the appropriate positioning, the areas in between create the mentioned social spaces. Each of these residential modules is equipped with the basic amenities of a common city apartment. A kitchen area with already connected appliances, a bathroom with prefabricated sanitary facilities and a spacious living area that can be furnished by the residents themselves will be provided. Of course, there is not only one habitation module but they range from smaller student and double apartments to maisonette or family apartments. The individual modules can extend over a length of almost 14 meters. A module of this dimension can be prefabricated cost-effectively from planning to execution. To connect the floors with each other, there are an external staircase and elevators on the north side of the building providing a barrier-free access to all storeys and apartments. The entire structure is enclosed in a climate shell. It is a vertical truss linked to the central structure over the entire height of the new additional stories, mounted with glass lamellas. Half of the lamellas are equipped with photovoltaic cells which have besides their insulating properties the ability to generate energy. All facade elements are closed airtight if needed but the lamellas and roof windows are openable for natu-

ral ventilation. The semi-public roof terrace is not just bringing the individual residential parties together, it also helps to embed the building into the community. On this level, you will find open areas with leisure activities and large beds for urban gardening.

Building Challenge

In order to carry the wooden modules on the existing building, we use a grid made of steel beams that is placed on the outer walls of the Café Ada. Each module comprises a small, well-organized single apartment and can be combined with other modules. This creates a flexible floor plan with attractive living space for different groups of people. Due to the variable floor plans, the modules can be prefabricated in series already including openings or milling for power and sanitary connections in the factory. The modules are structured in a way that they are four times longer than wide. The dimensions of the prefabricated elements are optimized in their dimensions for transport 14 m x 3.35 m x 3.35 m (l / w / h). The longer sides of the modules are closed so the modules can be lined up side by side and stiffened in themselves. Thanks to the bulkhead construction, in which the load-bearing long sides serve as reinforcement, the modules can be stacked freely. Each module has a central core function including pipelines and sanitary facilities. The residential modules are based on a system of solid wooden elements by our partner "holzius", enclosed by a semi-transparent climate shell.

Dissemination Activities and Current Impact

The dissemination of scientific information to the (professional) public is a central idea of the competition. As a result, an official homepage and pages on social media have been set up as a communication and presentation platform, now with a new CI and new logo. Thus, all target groups such as experts, the public, sponsors and companies as well as family and friends can participate in the current events of the team and its project status. Team MIMO located in Düsseldorf has a direct connection to the venue in Wuppertal. The team expects feedback from the general public, especially the people from the Mirke district, and is looking forward sharing our project with them.

Collaborating Institutions and Sponsoring Companies

Institution/Company	Type of business/branch	Type of Sponsorship
Vaillant	Heating technologies	Products / Know-how / Financial
SMA Solar Technology	Photovoltaic technologies	Products / Know-how
Ingenieurbüro für Bauphysik und Gebäudesimulation alware GmbH	Building simulations	Know-how
Ingenieurbüro Stahl und Weis	Planning	Know-how
Gira Giersiepen	Electrical engineering components	Products / Know-how
Miele	Home appliances	Products / Financial / Know-how
Albrecht Jung	Electrical engineering components	Products
AIT	Communication	Partner network / Publications
Transsolar	Climate engineering	Know-how
Holzius	Wood building components	Products
DAW SE – Caparol	Building components	Products

Alware GmbH, Ingenieurbüro für Bauphysik und Gebäudesimulation	Building simulation	Know-how
Hottgenroth Software GmbH & Co. KG	Software	Software systems
Caparol	decorative paints	Products
ECBM GmbH	Consultant in artificial intelligence / smart city	Coaching
Dessault Systems	Software engineering	Software systems / Know-how
Petershaus – Holzbau	Builder for prefabricated houses and wood components	Production
Schneider Electric GmbH	Technical building equipment	Products / Know-how
Stadtwerke Kempen	Electricity provider	Financial
Energy Endeavour Foundation	SDE 20/21	Financial
Hochschule Düsseldorf - University of Applied Sciences Düsseldorf		Financial
Faculty of Architecture	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial
Faculty of Mechanical and Process Engineering	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial
Faculty of Electrical Engineering & Information Technology	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial
Faculty of Social Sciences and Cultural Studies	Hochschule Düsseldorf - University of Applied Sciences Düsseldorf	Financial

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Project Images

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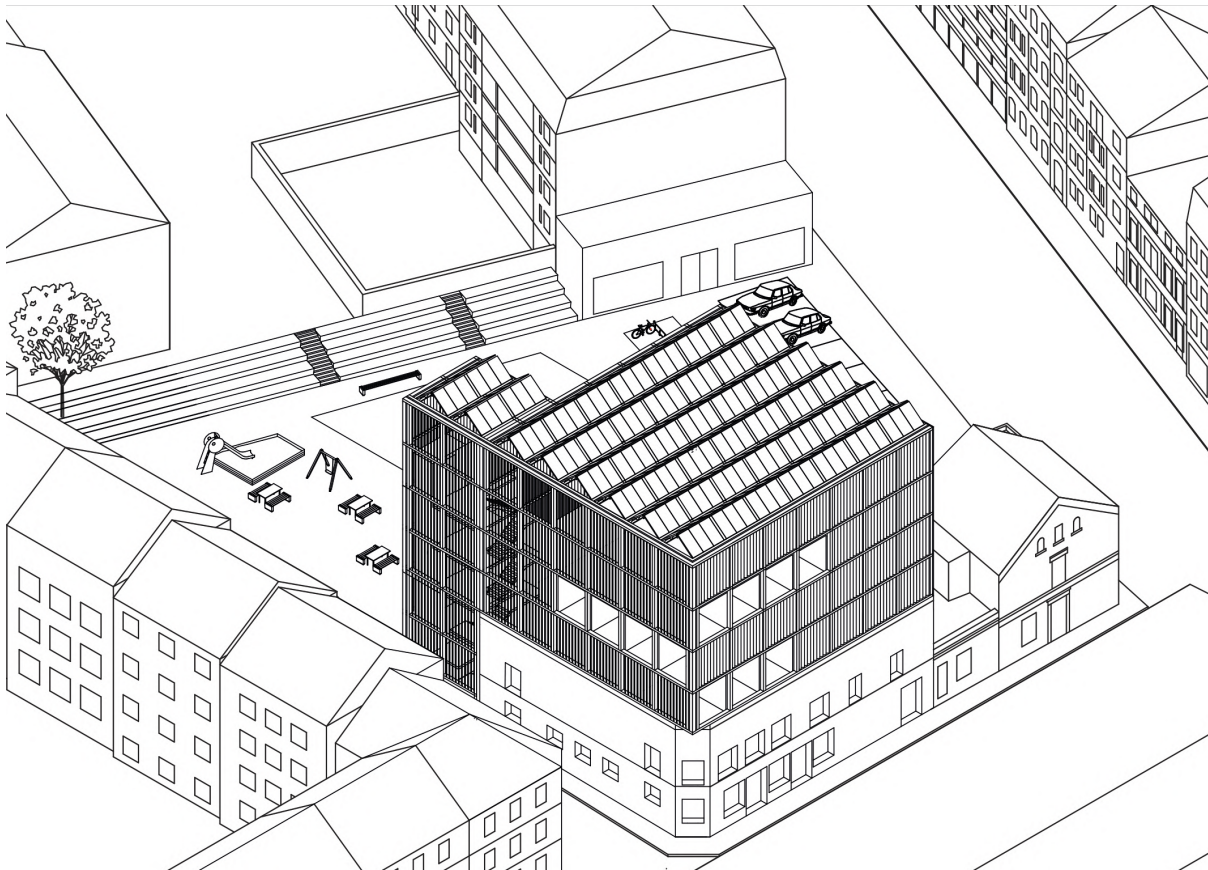
Logo Team MIMO



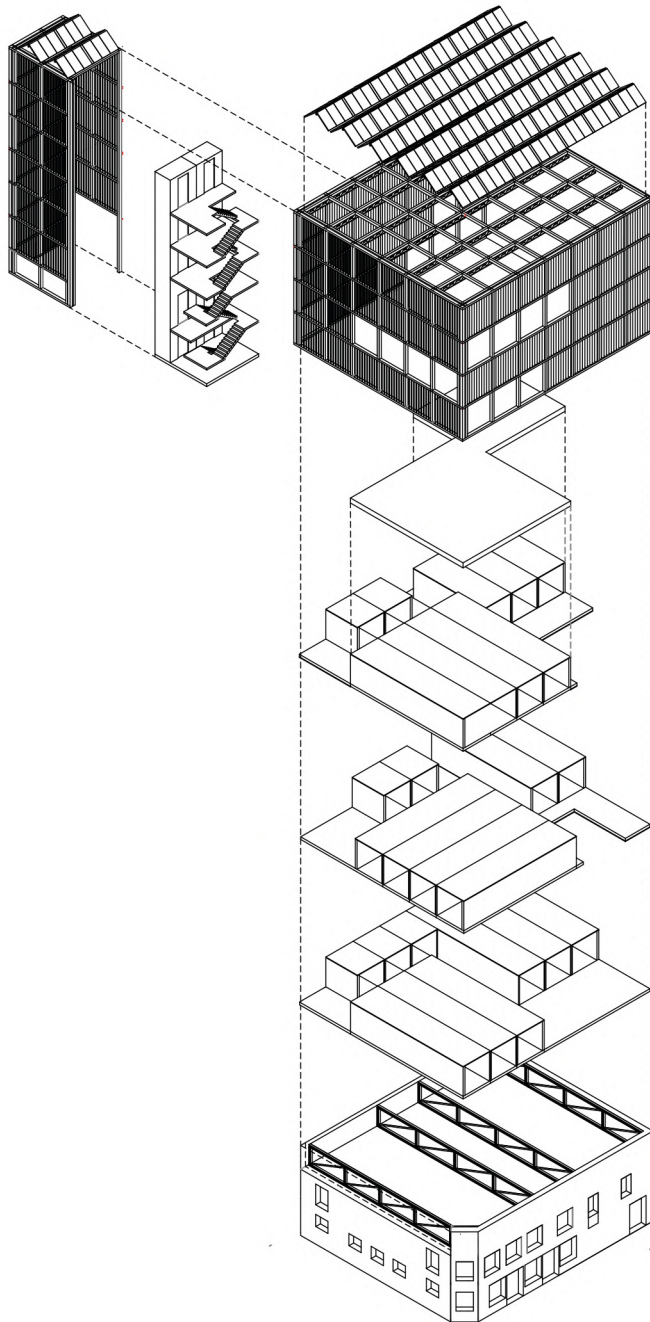
Team picture



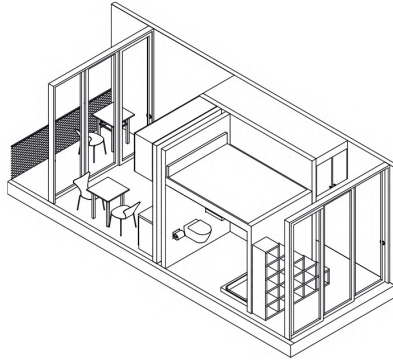
Design Challenge: Exterior Rendering – street view



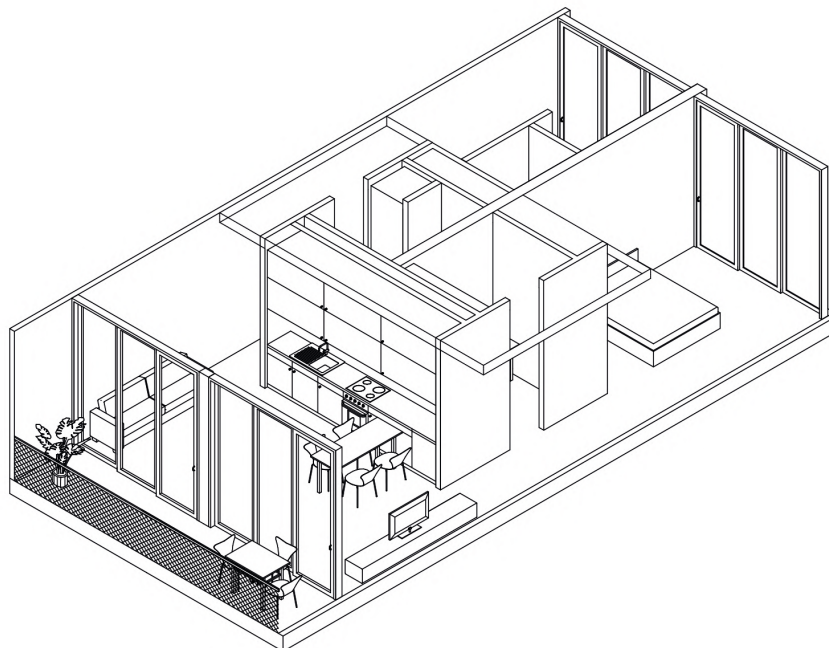
Isometry - Urban context



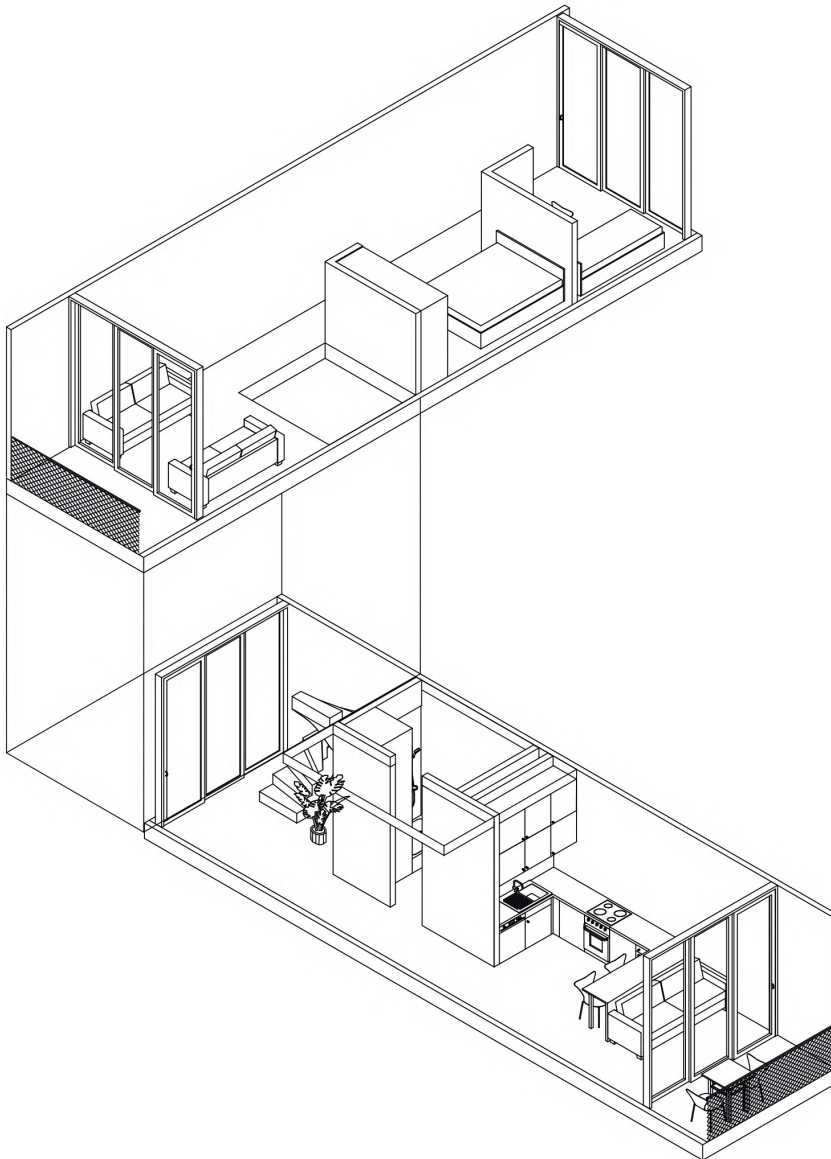
Isometry Building Design



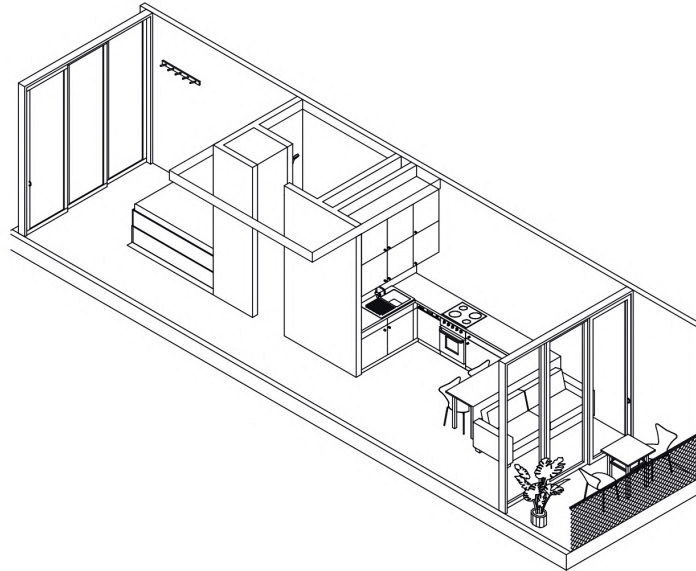
Student apartment isometry



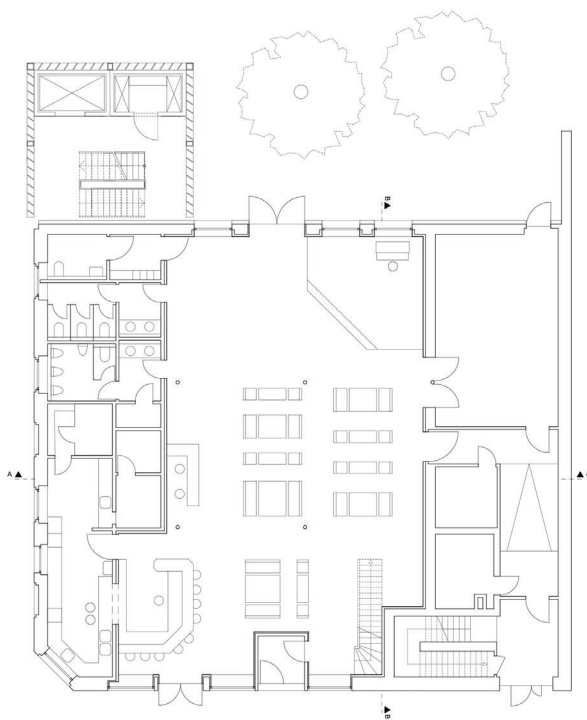
Family apartment isometry



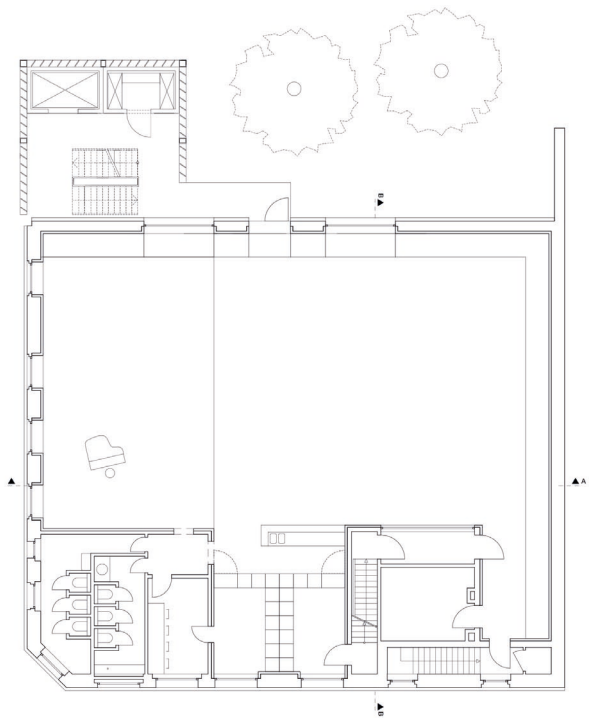
Maisonette apartment isometry



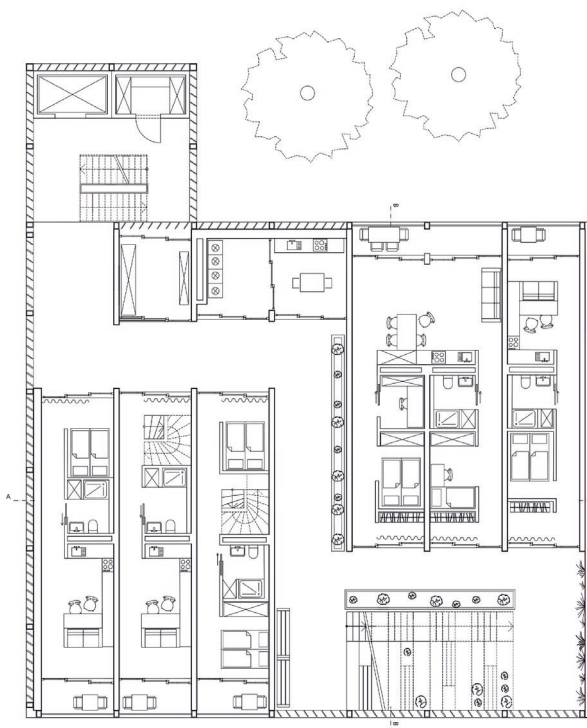
Double apartment isometry



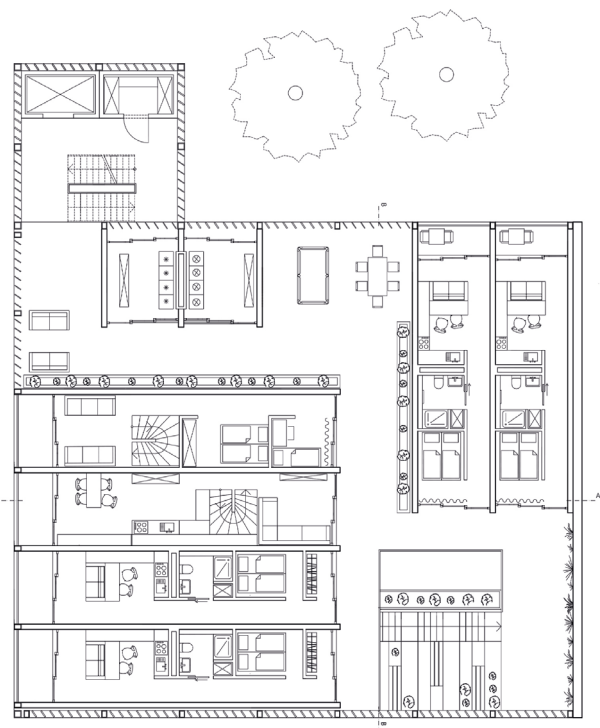
Floor Plan – First Floor



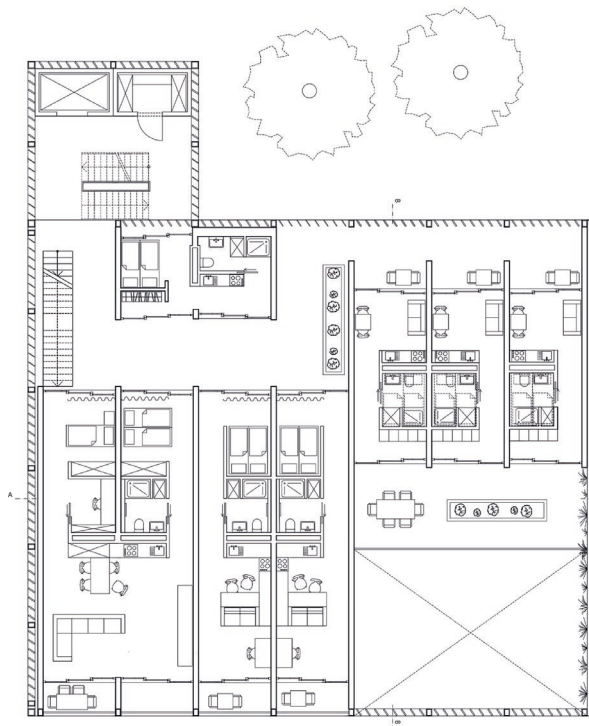
Floor Plan – Second Floor



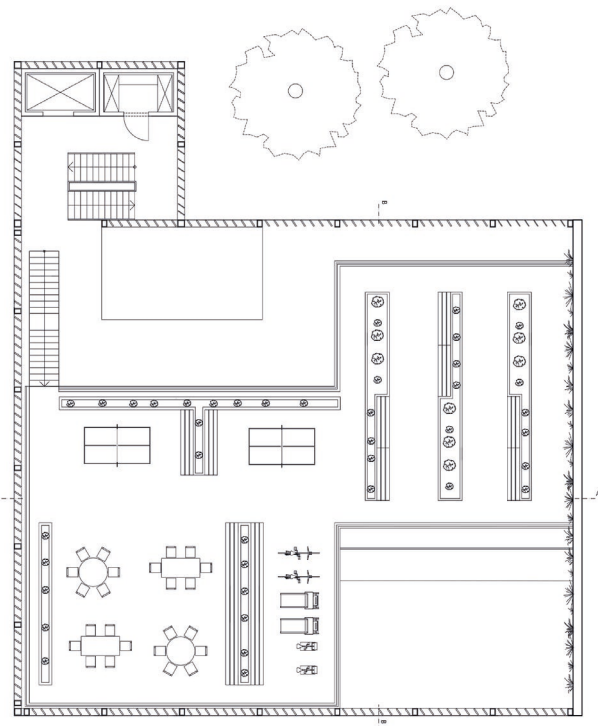
Floor Plan – Third Floor



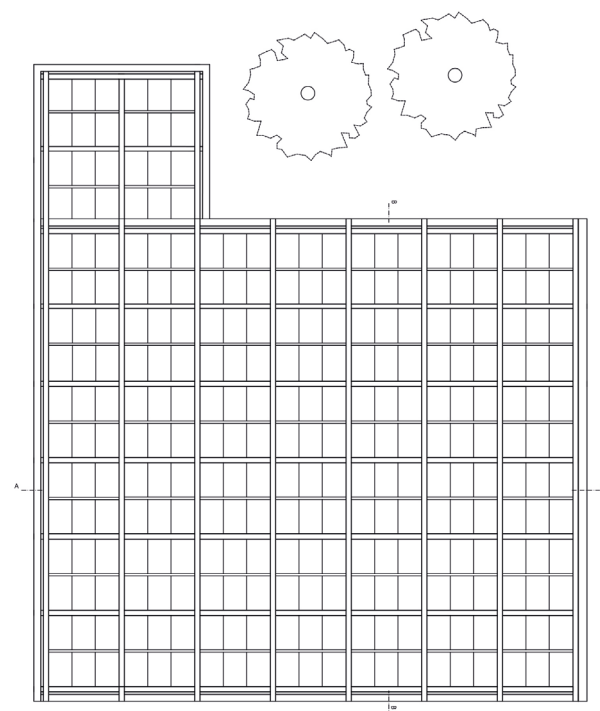
Floor Plan – Fourth Floor



Floor Plan – Fifth Floor



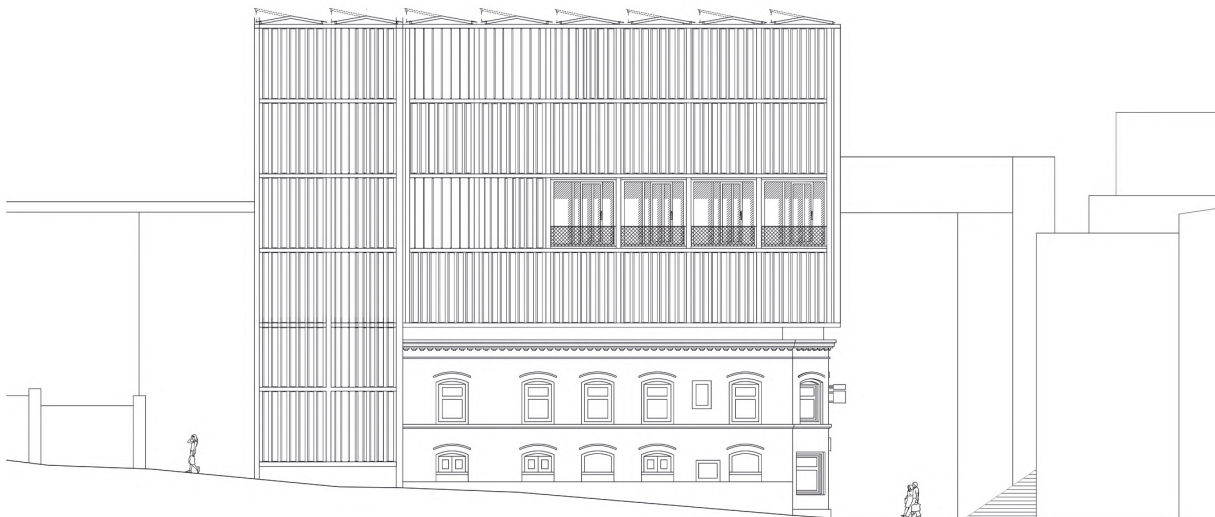
Floor Plan – Sixth Floor



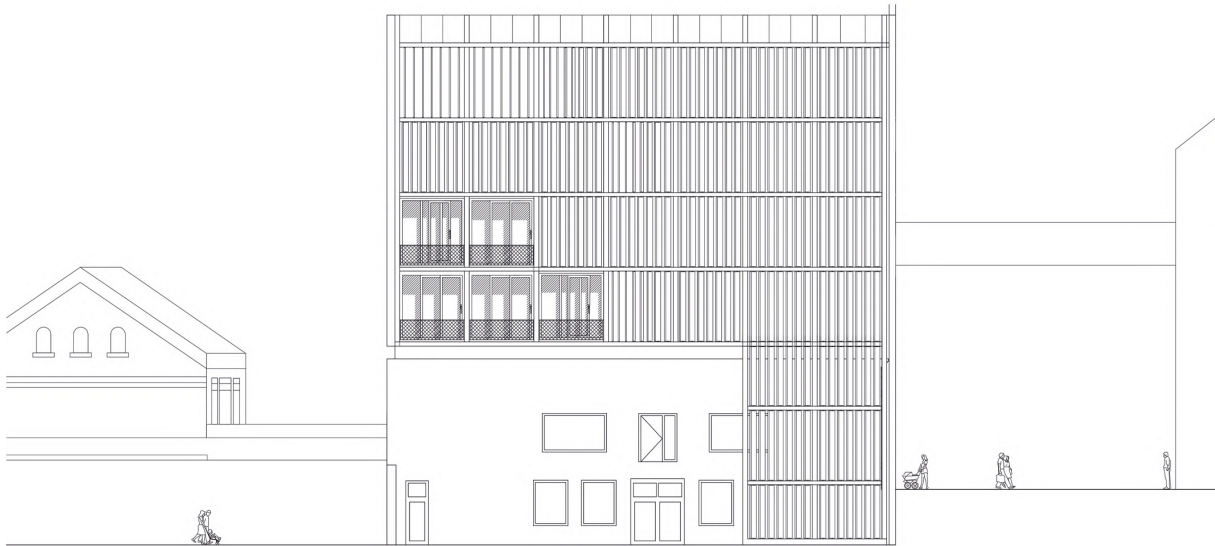
Roof Plan



Building Elevation - south



Building Elevation - west

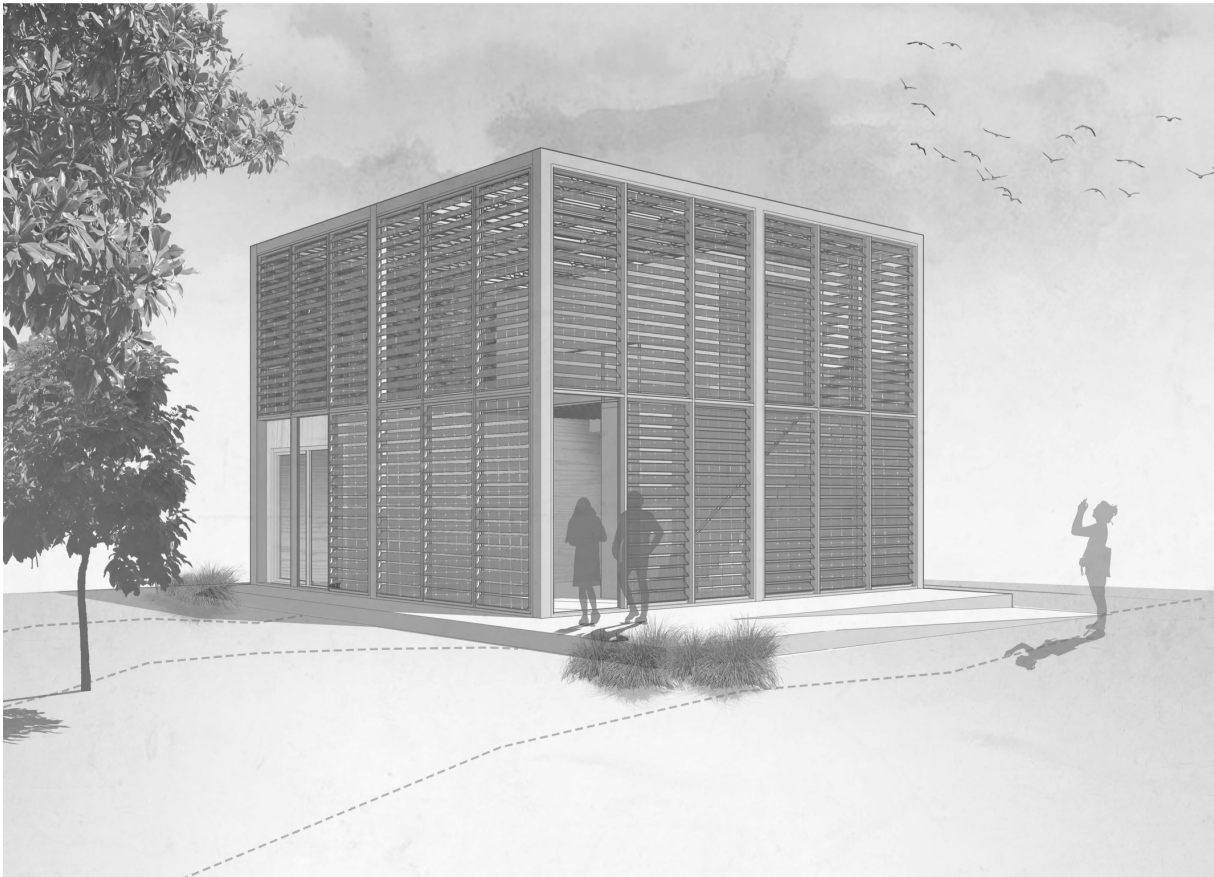


Building Elevation – north

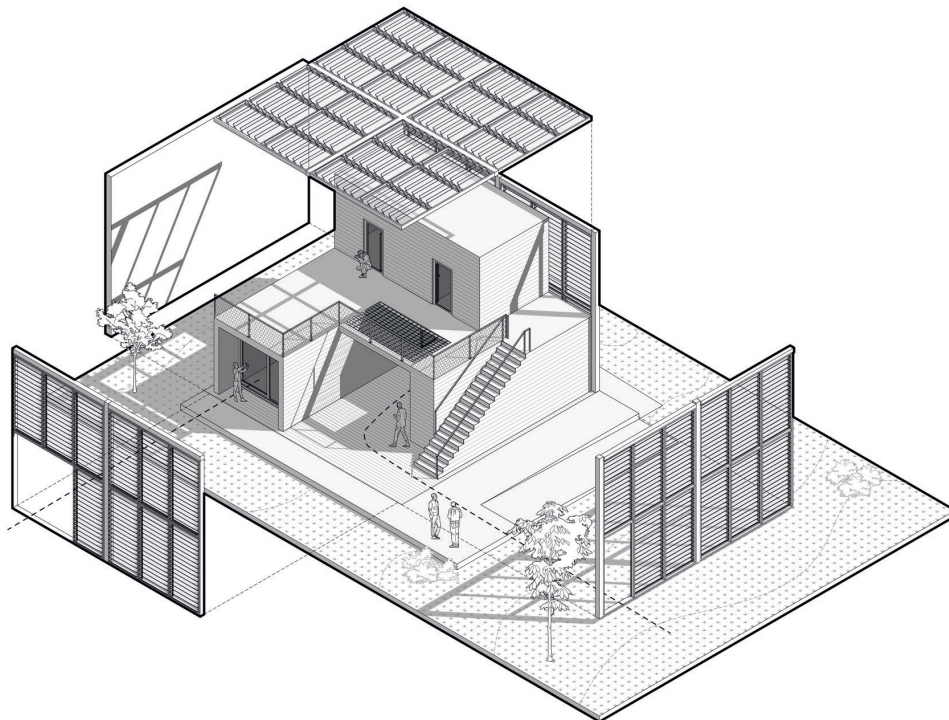


Building Section – AA

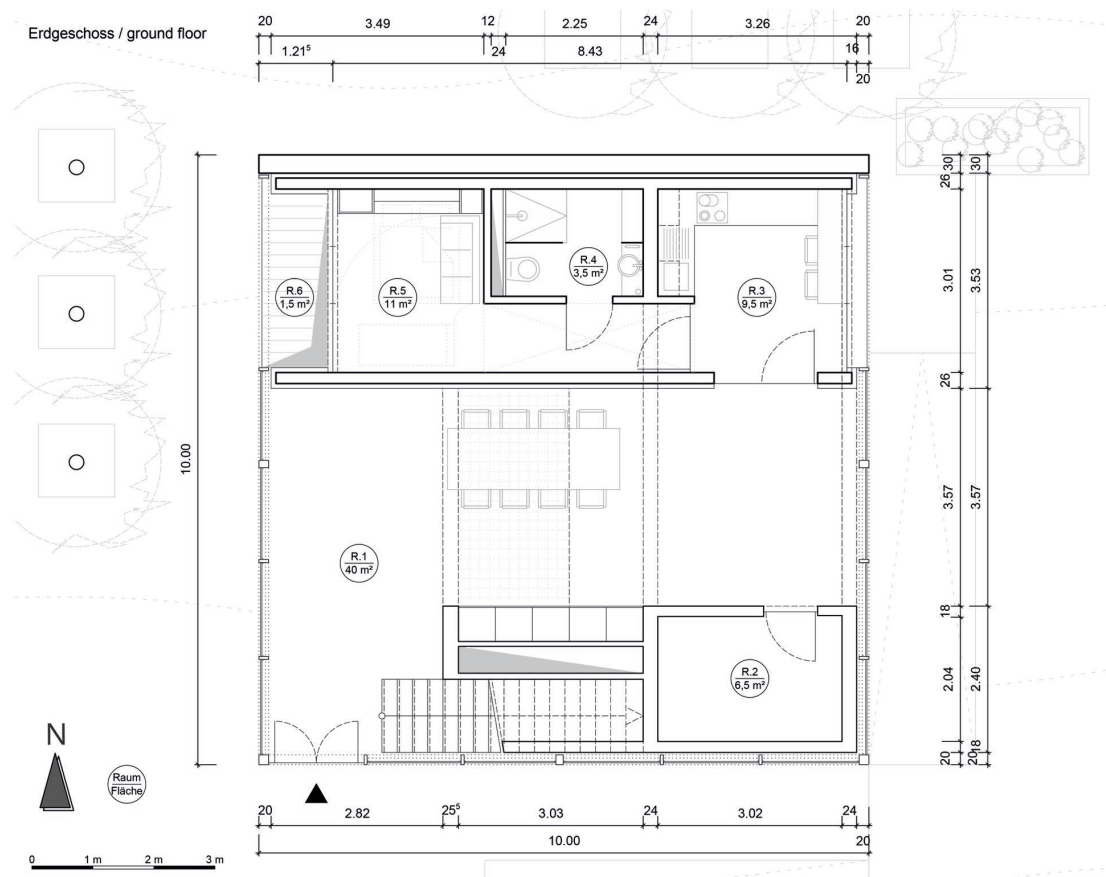
Building Section – BB



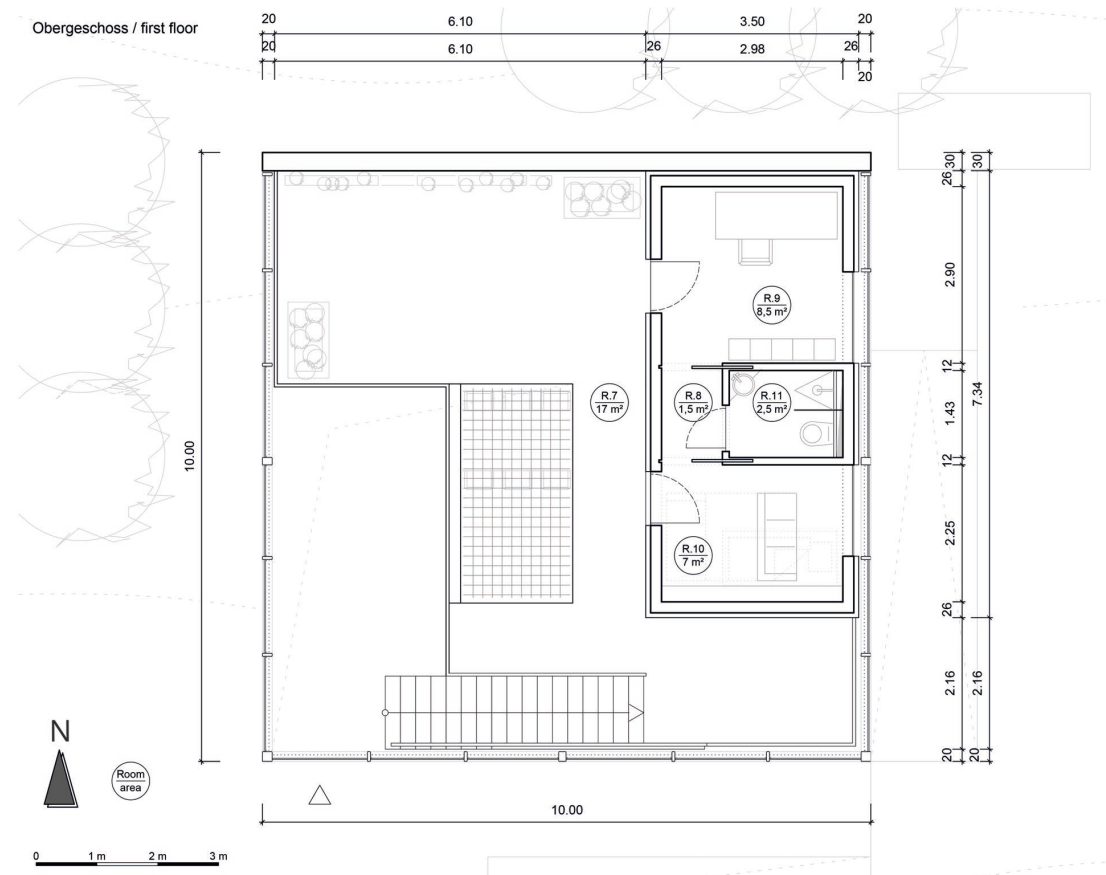
Demonstration Unit - Visualisation



Demonstration Unit - Exploded Isometry

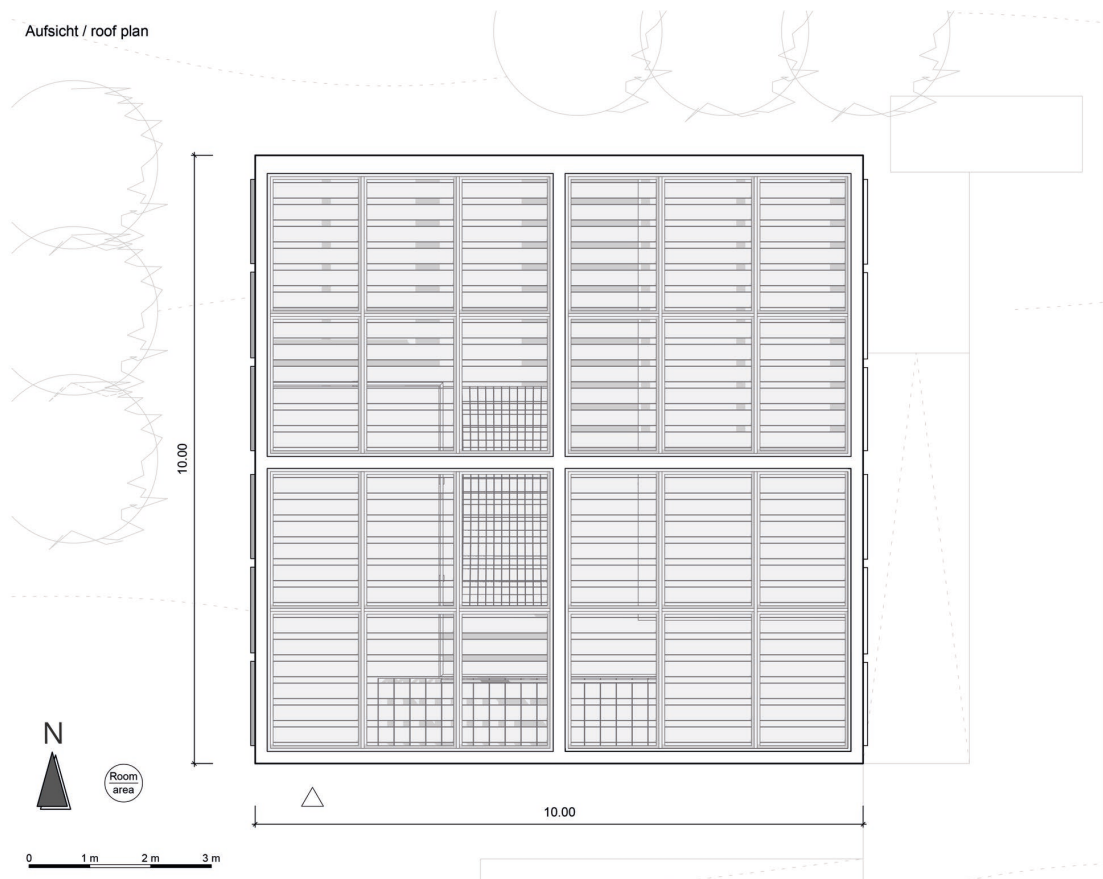


Floor Plan – ground floor



Floor Plan – first floor

Aufsicht / roof plan



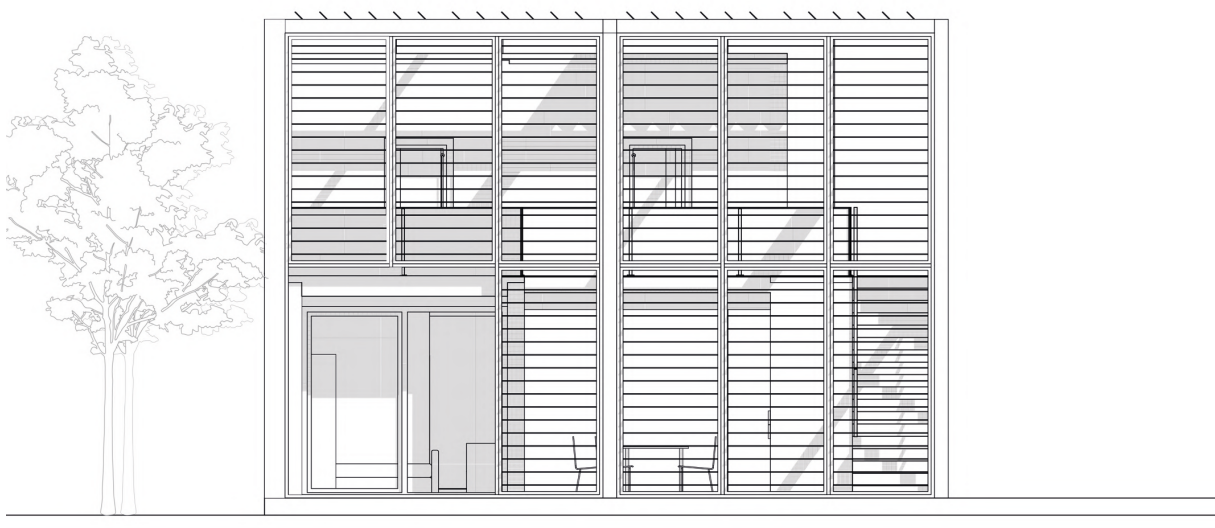
Roof Plan



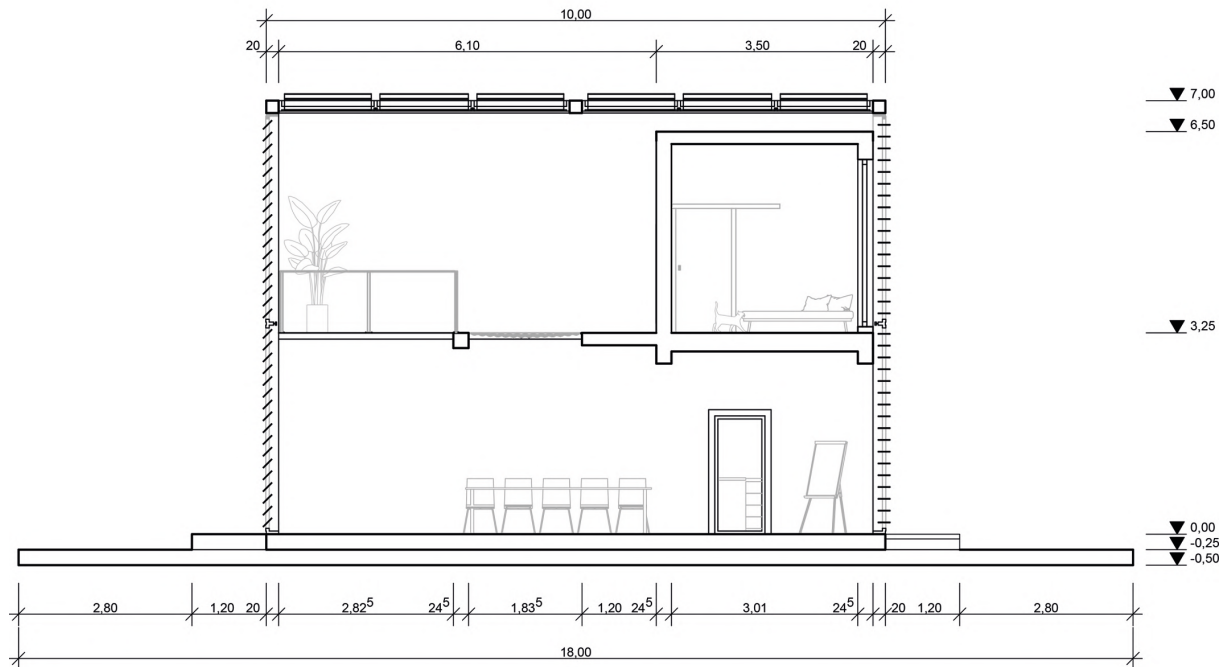
Building Elevation - East



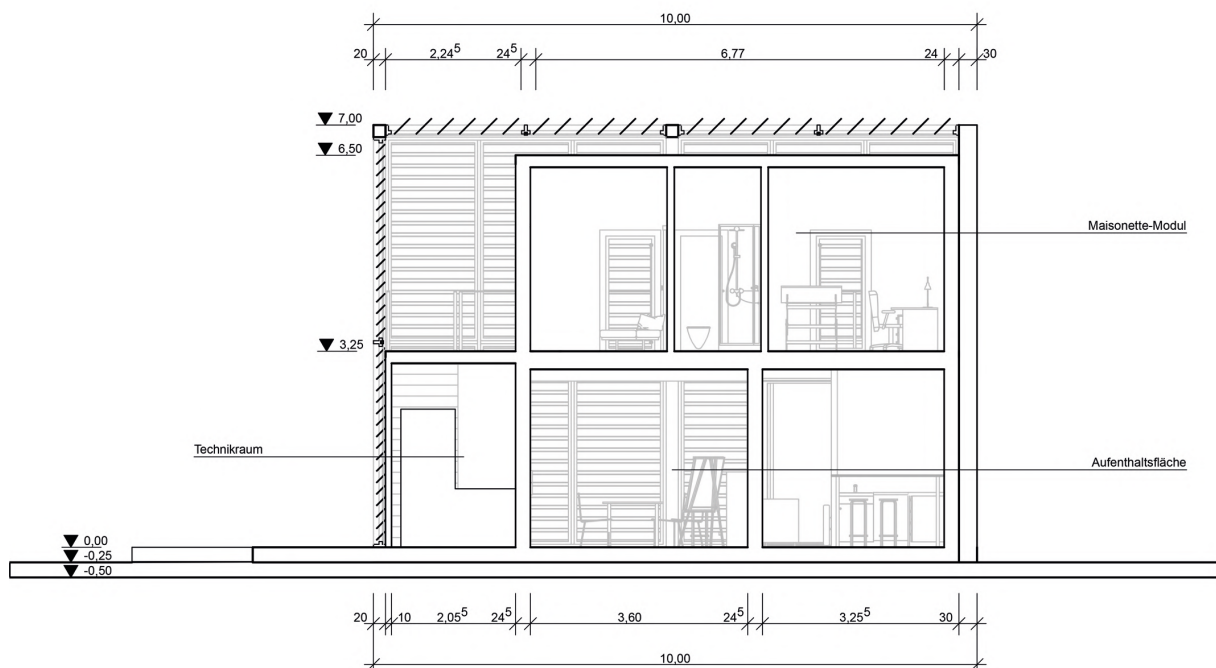
Building Elevation - South



Building Elevation - West



Building Section - AA



Building Section - BB