

“Residential commercial complex” at North Freight Railway Station in Vienna

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Master thesis

Concept for a mixed-use complex

FIT FOR LIVING

in Nordbahnhofgelände, Vienna, according to the passive house system

For the purpose of obtaining the academic degree of “Diplom-Ingenieur”
(graduate engineer)

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A special thanks goes also to Ms. Isolde Tastel for always being helpful.

Thinking of all those who have made this journey possible, not forgetting any single one of them.



Figure 1 - Tehran, Atisaz Residential Complex

Introduction

Although I have been dreaming about this moment ever since I was just a little boy, innocent enough to get easily amazed by watching the simplest forms of architecture, and although this is the result of my master studies in architecture, I have to confess that I still do not totally grasp the real essence of architecture. But at least now, it is clear to that little boy, that maybe it was not just the forms that blew his mind, but also the immense dimensions of the architectural masterpieces!

As times have changed, so have my dreams. Very little remains of that childhood innocence today. For each year that passed, my visions got bigger. Simple forms were getting dull and less interesting and I constantly wanted to see something even mightier and even more sophisticated. Now it is clear to me that architecture, as well as my perception of it, is something relative, varying constantly over time.

I grew up in a residential complex in Tehran, made up of several towers, each between 12 and 20 floors. In other words, I was living in a highly dense community. So it might be easy to imagine a group of curious young boys, running around, turning the place inside out, and exploring every little corner of it. We were experiencing the advantages and drawbacks of various features of architecture, with different vision of an ideal complex, fantasizing about features, which were not provided to us, and creating our own individual image of perfection.

Given this background, I always had a special preference for residential architecture and now I want to bring it to another level, realizing my visions. It is obvious that I am not the very first one to elaborate on this idea, but as we all have different preferences and perspectives, there might still be room for presenting other concepts of living.

Since the social element of living is nowadays often forgotten, I want to present an introverted complex, with a focus on social interaction between the residents and promotion of stronger links between the units.

How many people do really know who is living across the hall? Probably very few, but we do know about the latest design, technology and comfort in our living space. However, we have to keep in mind that the human being is a social creature. Modern residential complexes of today are proofs of architectural achievements and developments throughout the past decades, but at the same time a witness to degradation of social elements in architecture that are overshadowed by the egoism of the modernists and their wrong impression of the concept of privacy. Given the environmental concerns we are facing, green architecture is in the limelight. In my design I am trying to concentrate more on the positive effects of green architecture on our everyday life with respect to social aspects.

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Figure 2 - The position of the site in Vienna



Figure 3 - North Railway Station Site, Vienna 1020



Figure 4 - The North Railway Station, Master Plan

1 Project area

Designing and discussing about residential-commercial complexes should be related to the location, because they function within a specific environment and a human context. Not to forget, they contain their own community of residents, but they are also a part of the wider urban community and the dynamic relationship between these two communities must be considered both at the planning and at the designing stage.

The chosen site for this project is a part of the Nordbahnhof/Rudolf-Bednar-Park site, in the second district of Vienna with an area of 10.700 m², which in 2009 has been the site of a competition for a mixed residential building with the same purpose as my project. The site is in the vicinity of the U1 metro station Vorgartenstrasse and is now being developed by Baumschlager Ederle.

1.1 Master plan Vienna North Freight Railway Station¹

It is undisputed that there is an increasing significance in terms of developed traffic as well as inner-city areas for commerce, business services, housing construction and many other realms featuring modern, urban quality of life.

The 650.000 square meter area surrounding the Vienna North Freight Railway Station is in the immediate vicinity of the Vienna Praterstern Railway Station, which in 2008 was rebuilt into one of Austria's most modern railway stations. This area is currently being integrated into the city of Vienna as a new district and is only ten minutes away from the city centre.

The site is located between the first district, the city center, and the 22nd district, the business district of Vienna. The 22nd district attracts daily many workers who commute from different parts of the greater city area. Residential complexes on this site are therefore very efficient since they reduce the high demands for housing close to the city center and offer a better price for higher quality.

Accessible via metro lines U1, U2 and numerous other public transportation lines such as buses and suburban trains, this "city spot" is developing into one of Vienna's most important traffic junctions. As a result of the integration of the extensive urban area with the direct development axis between the inner city and "Danube City", the realization of this project is becoming a potential impulse for all of Vienna.

The large-scale project with an overall development area of 1.2 million square meters will influence the cityscape in the most modern way. It connects the city with green recreation areas such as the Danube River, Prater or Augarten in a manner featuring gentle urban planning, and creates an optimal network development with the main locations of Vienna business life such as the inner city, "Danube City" and the Exhibition Center.

The site with an area of 75 hectare is owned by the Austrian Federal Railways (ÖBB). About 10.000 dwellings and 20.000 jobs including related facilities would be settled here by 2025.

¹ All the information of this chapter, when not mentioned the reference are from:
<http://www.wien.gv.at/stadtentwicklung/projekte/nordbahnhof/index.html> [14.12.2010]
<http://www.oebb-immobilien.at/de/Pressecorner/Publikationen/Projektentwicklungsfolder/wien-nord.pdf> [22.11.2010]

1.2 History of the North Railway Station²

The first station built on this site was built during the construction of the Nordbahn, inaugurated on January 6, 1838 as K.k. Nordbahnhof (Imperial and Royal Northern Railway Station) in compliance with the style of names of virtually all public works rendered at the time. The entire system consisted of six L-shaped buildings; the waiting hall, the apartment, the magazine, the wagon shed, the locomotive shed and the workshop building.

Due to rapidly rising passenger numbers, the station became too small very quickly and had to be rebuilt. Between 1858 and 1865, the station building in the vicinity of Praterstern was built. Like all other stations in Vienna at this time, the Northern Station was planned to be an exhibition building. Several architects were assigned to planning the building; interior decorating was done by sculptors and fresco painters.

The station was inaugurated on November 15, 1865. In the days of Austria-Hungary, the station was one of the most significant stations in Europe and Vienna's primary railway station, connecting Vienna with Brno, Prague and Warsaw. For many immigrants, it was the door to Vienna.

During World War II, the station was severely damaged by bombs and subsequently fell into disuse; it was finally demolished in 1965. The new building was constructed directly at Praterstern for logistical reasons and was inaugurated on June 1, 1959 as Bahnhof Praterstern. On September 1, 1975, it was renamed Wien Nord.

In 1997, the Austrian Federal Railways started a nationwide renovation initiative, in the course of which it was decided to completely rebuild this station according to the proposal by architect Albert Wimmer. Its features include a transparent roof for the station and its platforms and improved interchange with the metro, trams and buses. On platform level, the new station was completed in April 2007; prior to that it had been renamed to Wien Praterstern again with the introduction of the new timetable in December 2006.

The new station offers 6.000 m² of space for businesses and service enterprises. Platforms were raised to 55 cm above the trackage to make boarding and disembarkation easier. A tactile orientation system is planned for blind people.

The reconstruction started in 2004 and was completed in April 2008.

1.3 Reconstruction of the freight station

The area of the former freight station, no longer needed by the Austrian Federal Railways, is planned to become a new city district. The part on the Lasallestraße was already developed in the 1990s, almost entirely as office buildings. At first, a new line parallel to these blocks is planned. Gradually, the area is to be expanded to the northwest. The tram and bus lines are planned to be extended into this area as well. However, the time horizon of this project lies around 2025.



Figure 6 - "Kaiser-Fredlinand-North-Railway"



Figure 5 - Station hall 1866



Figure 7 - Nordbahnhof K.k.s Reception room with Carl Schweningers wall painting

² <http://www.wien.gv.at/stadtentwicklung/nordbahnhof/planung.htm>, [14.12.2010]
<http://www.ziel2wien.at/dt/portal/content.php?navId=142®ionId=139&topicId=1&language=dt&groupName=>,
[14.12.2010]

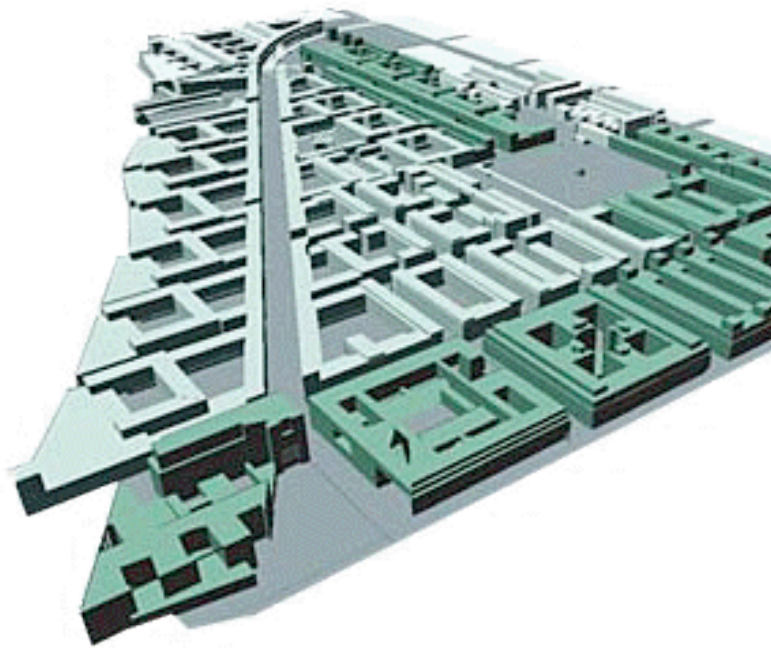


Figure 9 - Third level of construction - North Railway Station

1.4 Principles for the development of the North Railway Station

- Extensive use of the site due to its excellent public infrastructure and the inner-city location as well as for the minimization of the use of the city's peripheral green area.
- Priority for the structural integration into the local urban landscape, both from a functional as well as from a creativity point of view.
- Pursuit of a mixed urban structure, as is typical for the densely built area of Vienna. This applies equally to the utilization structure, the building structure as well as the demographic and social structure.
- Consideration of environmental aspects in urban planning.
- Smooth integration in terms of environmental impact.
- Full infrastructural services, including the compensation of any shortcomings in the surrounding area.
- Innovative system solutions with regard to the use across the entire densely built area of Vienna.
- Priority for adaptive and viable urban solutions as well as process developments for ensuring quality and error prevention, in order to broaden the public opinion and adaptability to a changing environment.³

1.5 Space value

- Gross construction area: 75 Hectare.
- Planned gross floor area: 157 Hectare, thereof for
- Housing: 98 Hectare (61 percent)
- Offices: 38 Hectare (23 percent)
- Shops/small businesses: ten Hectare (6 percent)
- Infrastructure, i.e. school, day-care for children: eight Hectare (5 percent)
- Industry: three hectare (2 percent)
- Local parks, public spaces: five hectares (3 percent)⁴

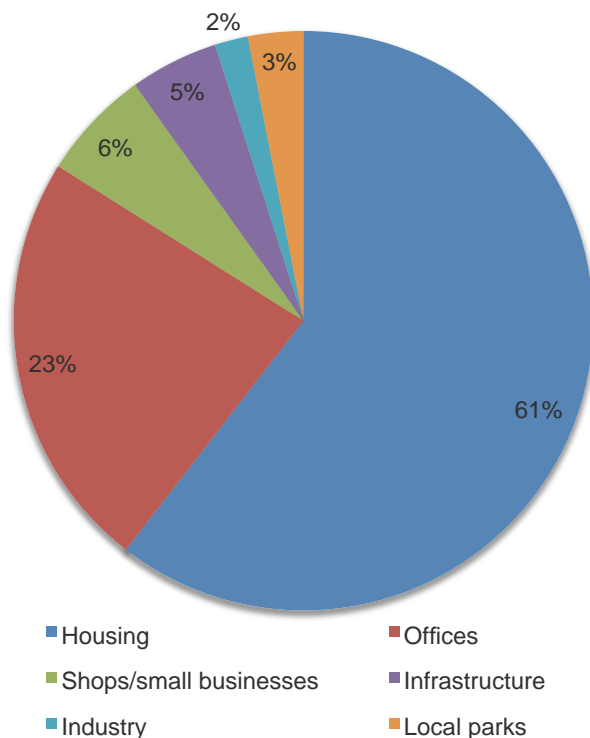


Figure 8 - Planned gross floor area of the North Railway Station

³ <http://www.wien.gv.at/stadtentwicklung/projekte/nordbahnhof/leitbild.html> , [18.11.2010]

⁴ Ibid

Site analyses



2.1 Distribution of functions

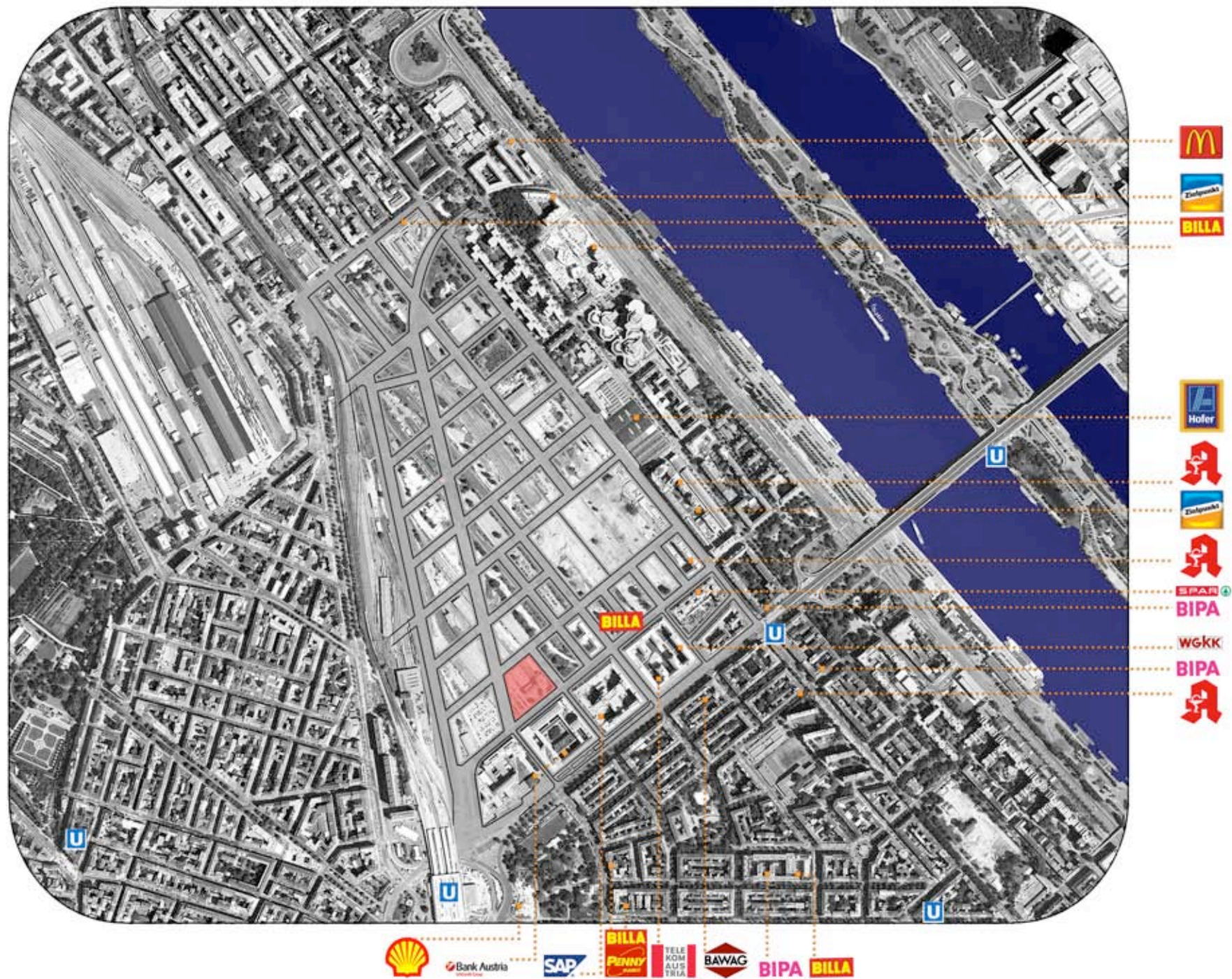
In this new type of inner urban expansion there are many facilities with a wide utilization range. All needs and functions with regard to working and living, such as culture, education, office and retail, but also leisure and recreation, are provided for. Green zones in the site serve as communication and networking centers, which are multifunctional, individualized and centralized. Working and living, shopping and recreation, sport and culture, social contacts and contemporary design - all this will be connected to each other through Green Centers.



Figure 10 – Distribution of functions - City of Vienna, MA 41

2.2 Distribution of facilities

Different facilities in the vicinity of the site provide the residents with more comfort. Shopping, banks, pharmacies, restaurants, petrol stations, etc. are some of them.



2.3 Buildings designed for the neighborhood

There are several buildings in the neighborhood that have either recently been constructed or are at the moment of writing this thesis still under construction or in the planning stage.



2.4 Construction site



Figure 12, Construction site



Figure13, Traffic situation

2.5 Traffic situation

The North Railway Station site is limited in the north to Innstraße and in the south to Lassallestraße and Praterstern, and stretches from east to west between Vorgartenstraße, Engerthstraße and Dresdner Straße, Nordbahnstraße respectively.

Due to its location on the axis between the “Danube City” and the city centre, this urban development at the North Railway Station site brings a new impulse for the entire city and especially to the second district. The new urban quarters illustrate an image of strong contrast in comparison to the historical parts of the Leopoldstadt district.

The free platform along the Nordbahnstrasse is a strong barrier between the new site and its residential neighborhood to the west. The 20th district borders the site from the northeast and is just two blocks away from the Danube. From the south, the successful development of the city in the 1980s on the Lassallestraße separates the new site from the historical neighborhood called Stuwerviertel.

2.6 Public transport

Praterstern, located to the south of the site, is one of the most important public transportation hubs of Vienna with new high-speed and regional trains.

The U1 metro line, which serves between Leopoldau and Reumannplatz, has two stations along the Lassallestraße, Vorgartenstraße and Praterstern. Since 2008 the U2 metro line also has a new station at nearby Praterstern and was in 2010 extended to Aspern Seestadt, which is now its most remote station. In addition to the metro, the tramlines 5, 2 and O, and three bus lines (11A, 80A and 82A) are serving the area.⁵

⁵ Urban development Vienna, [22.11.2010] <http://www.wien.gv.at/stadtentwicklung/projekte/nordbahnhof/ausgangslage.html>

Metropolitan area map



2.6.1 Public transport

Access to the site through Handelskai, Innstneiaße, Lassallestraße, Nordbahnstraße and Praterstern provides a well-connected road network.



Figure 13 – Public transport, MA 21

2.6.2 Car and Stationary traffic

The streets are mostly wide enough and ready to provide some parking space along the sides. Some buildings are equipped with underground garages and not only will they serve the residents but will also be mostly open to visitors of respective building.



Figure 14 - Car and Stationary traffic, MA 21

2.6.3 Bicycle and pedestrian lanes

The site has its own well-functioning network of sidewalks and bicycle lanes that are well connected to the already existing urban network, especially to the nearby recreation areas of the Prater and the Danube Island.



Figure 15 - bike and pedestrian lanes, MA 21

Weather statistics

2.7 Weather conditions at the site⁶

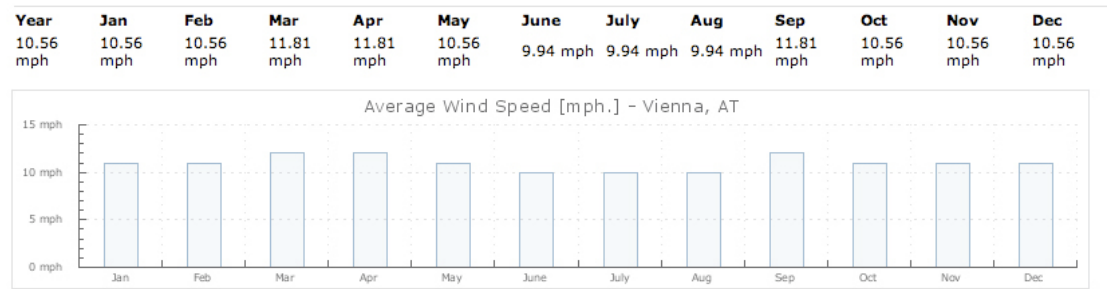
According to annual statistics based on observations taken between September 2009 and December 2009 (daily from 7.00 to 19.00 hours in Hohe Warte, Vienna), average wind speed is 7 knots, wind probability is 21% and average air temperature in the inner city is 11 °C.

2.7.1 Wind Direction

The most frequent wind directions in a normal year is west with 25% followed by the northwest wind 23%. North wind occurs in only 5% of all dates. The other main wind direction is the southeast in the summer time, which will provide the inner yard with fresh air. The northeast is the most rare reported wind direction. The major wind direction throughout the year is along the northwest-southeast axis.

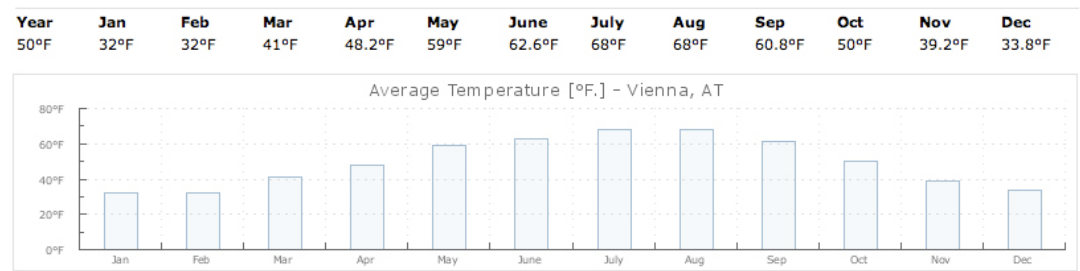
2.7.2 Average Wind Speed

At the height of 10m above the earth the annual wind speed average is about 2.9 m/s (10.4 km/h) at the investigated site.



2.7.3 Average Temperature

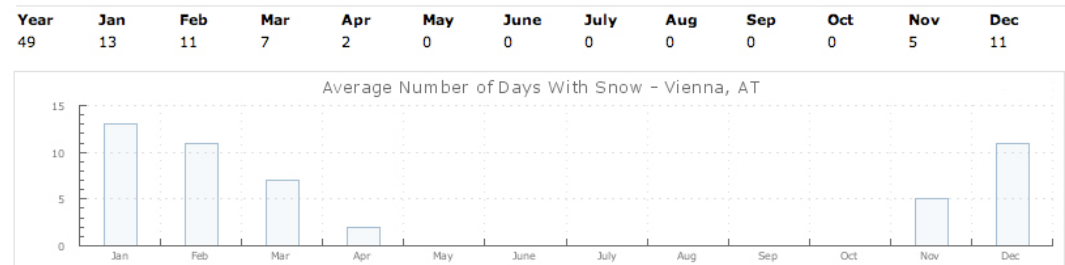
The average annual air temperature in the inner city is 11 °C.



⁶ Steinhäuser, Umweltverträglichkeitsprüfung Nordbahnhof Wien – Klima, , [19.10.2010]
Historic weather statistics for Vienna,city center www.kinkaa.com/weather/Vienna , [10.01.2011]

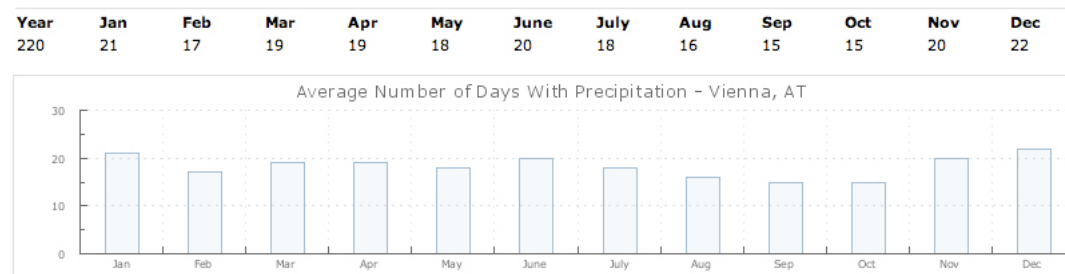
2.7.4 Average Number of Days with Snow

18% of the precipitation is in solid form. In a normal winter, there is a snow cover of one cm or more for 30 days. The highest measured daily fresh snow in Vienna during this period was 21 cm deep.



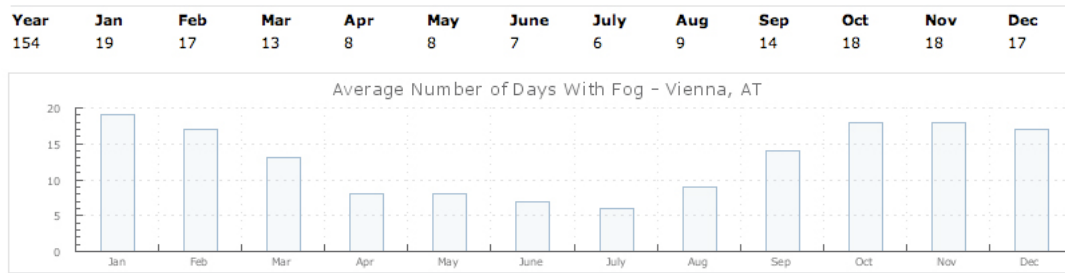
2.7.5 Average Number of Days with Precipitation

The average number of days with precipitation is 220 days per year. The average amount of annual rainfall is about 570 mm.



2.7.6 Average Number of Days with Fog

The frequency of fog is indicated by the number of foggy days. In the inner city, the average number of foggy days is reduced by up to 50%.



2.8 Energy demands

2.8.1 Sun as a source of energy⁷

The potential energy of the sun is virtually inexhaustible and counts as the most important energy supplier for the future. Sun provides us daily with about eighty times the primary energy that is needed on earth. After deduction of the loss to the atmosphere, an average of 1000 W per m² reach the earth's surface. Considering these records the importance of the passive house system becomes more clear and the needs for it more obvious.

A cost-optimized system can cover about 40-60% of the entire low temperature heat demand in a house. In summer this means that more than 90% of the required hot water can be produced with solar energy. In the winter months and transitional periods, the supplied energy is always sufficient to preheat the domestic water.

The highest solar gains for a building can be generated with solar collectors and photovoltaic installed at the highest levels of the building with the proper angle facing the sun. In summer (April to September), an angle of 25° is ideal and in winter, between 70° and 90° produce the highest yield (data specific for Vienna).

Final energy consumption for residential building in Austria (%)

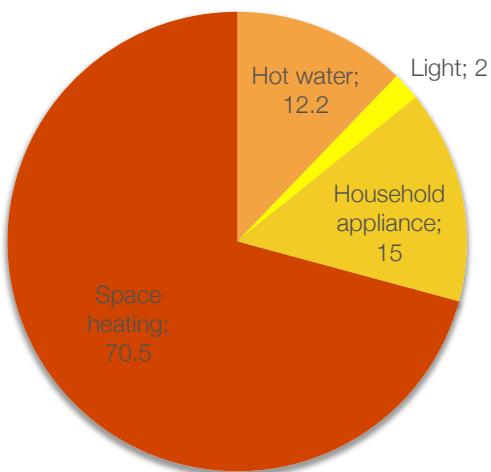


Figure 16 - Energy Efficiency Policies and Measures in 2007

2.8.2 Energy consumption – why passive house?⁸

Space heating accounts for 75% of our energy demand. Building and living is regarded to be that sector of life, which is most harmful to our climate. For instance, an approximate of 3000 kg oil equivalents per capita still vanish into air every year for providing hot water and space heating (example for Western Europe). However, 90% of this energy can be saved today without high investment costs, which in many cases is even state-sponsored.⁹

Compared to the passive house standard, not only conventionally built new houses but also more progressive types such as the low energy house are comparatively expensive and that is why the passive house standards are most often in the front line.

Final energy consumption for residential building in Germany (%)

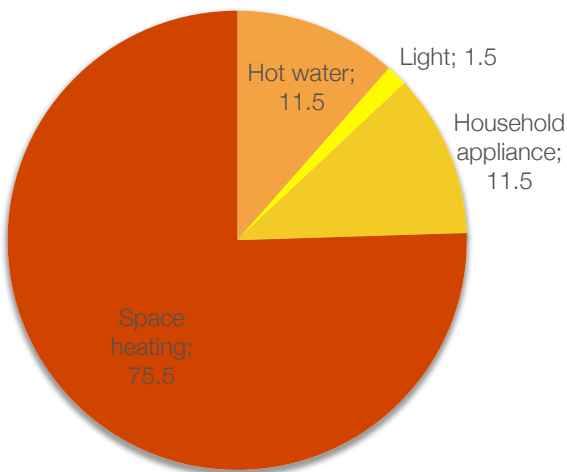


Figure 17 - Energy Efficiency Policies and Measures in 2007

⁷ Passivhauses, Ing. Günter Lang, Mathias Lang, Basic planning, construction and calculation principles.

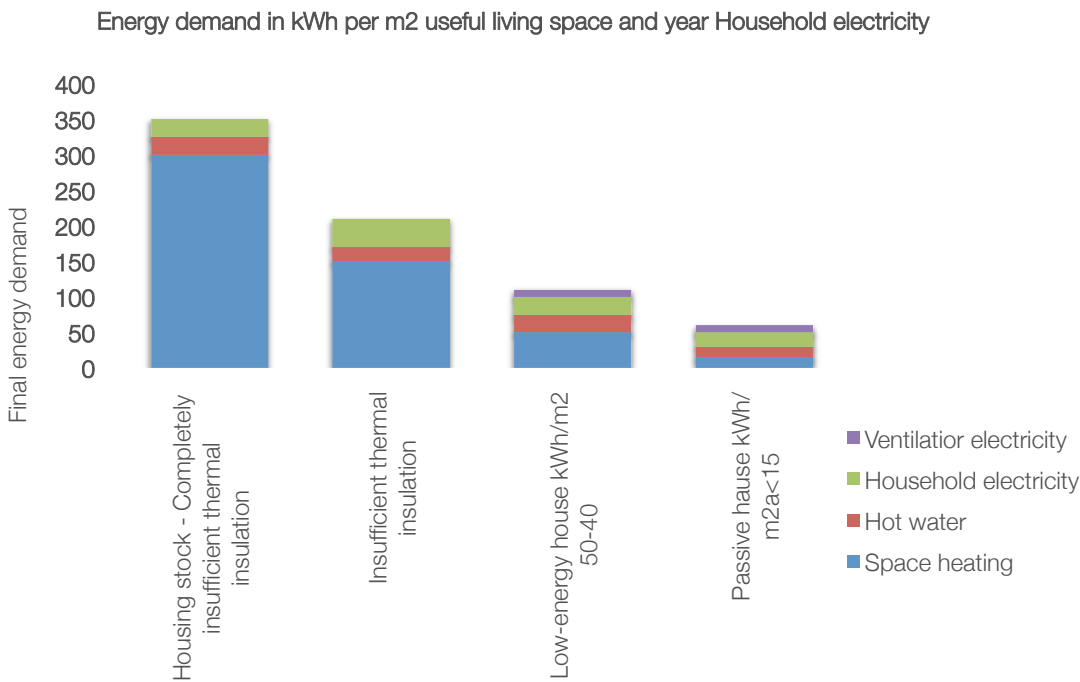
⁸ Niedrigenergie- und Passivhäuser, Published by Othmar Humm, low-energy and passive house building.

⁹ Multi-Comfort House, <http://www.isover.at/>, [04.02.2011]

2.8.3 Energy savings of up to 75 %.

The energy coefficient or U-value of housing is the best indicator of its economy. Compared to conventionally built new houses, the space heating requirement of a passive house is lower by about 75%. In contrast to old buildings, savings amount to as much as 90%. In cold winters, a room of 20 m² can be heated with just two 100-watt bulbs. In terms of fuel consumption, a passive house needs less than 1.5 l heating oil or 1.5 m³ natural gas per square meter and year.

Houses with their ideal southern and west-southern exposure remain even under the maximum annual heating demand of 15 kWh per square meter and year.¹⁰



2.8.4 Shading and air circulation

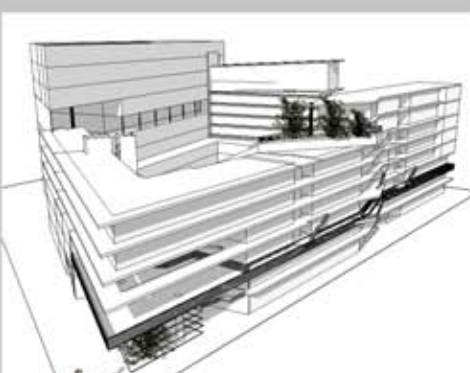
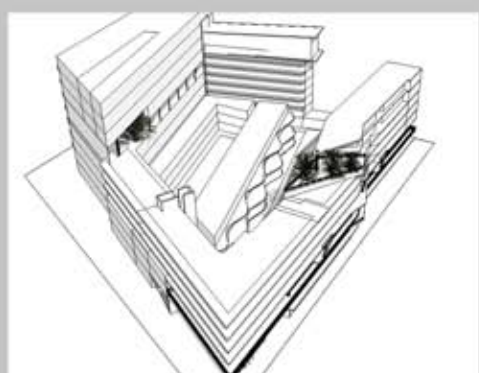
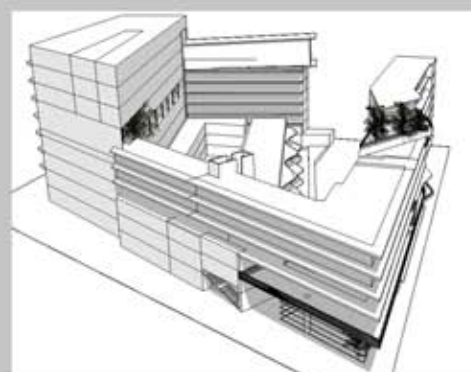
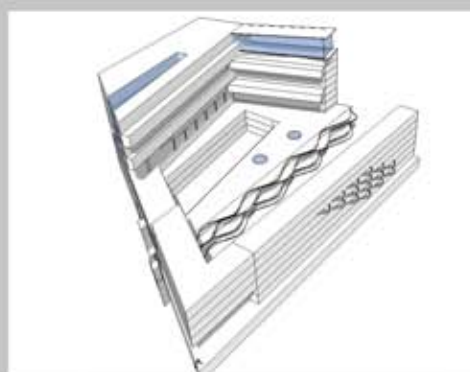
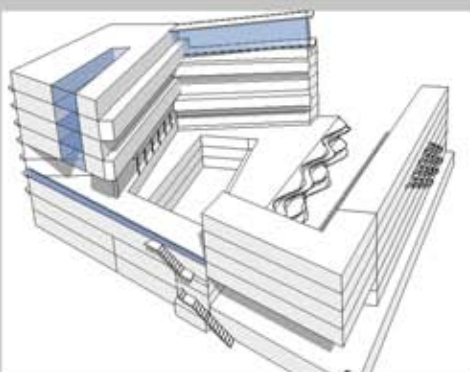
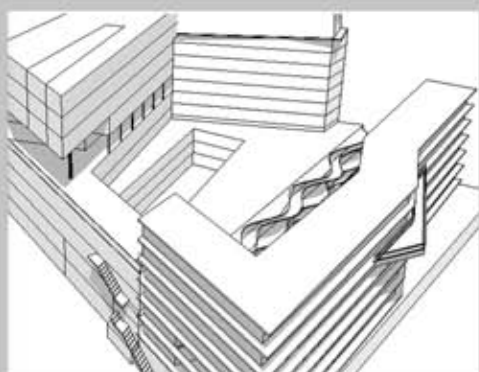
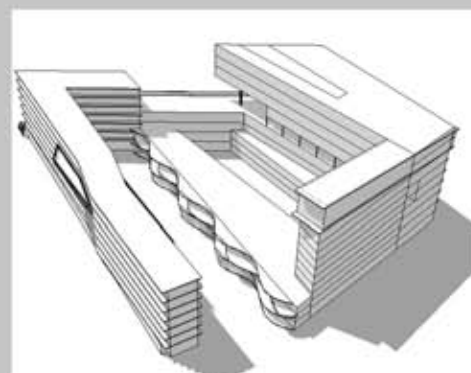
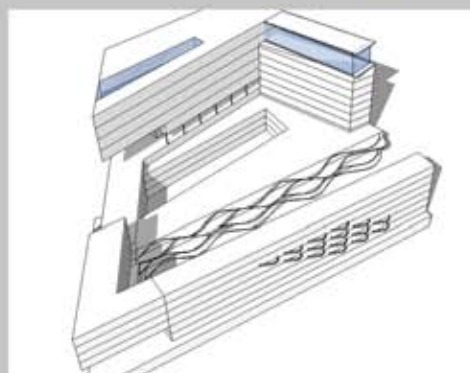
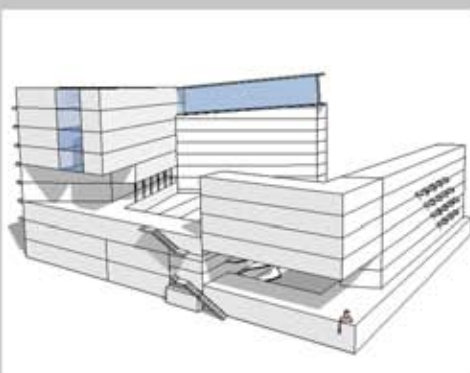
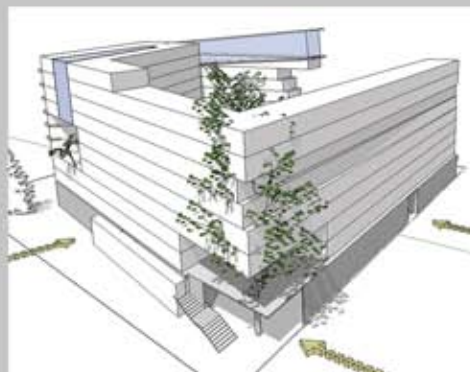
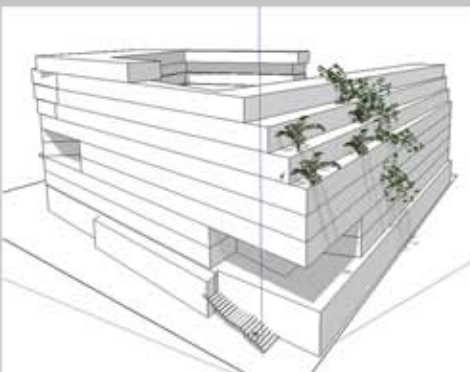
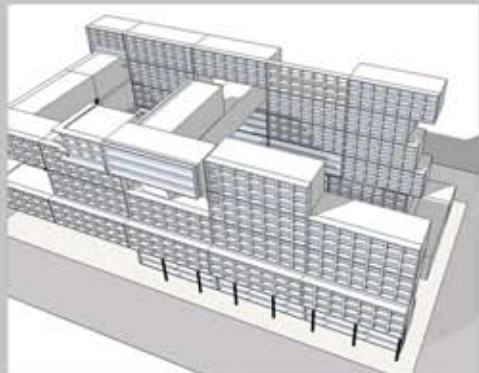
In each densely populated urban area “shading” is considered as an important factor in passive house. The overshadowing of shorter buildings by taller ones should be avoided whenever possible. This fact needs more attention in sustainable residential housing. Studies of the project site show that the average building height around the site is between seven and ten floors, except educational and recreational centers that are around 4 floors high. The complex that I am going to present for the chosen site will have seven floors.

¹⁰ Passivhäuser planen und bauen Instituts, (PHPP Passive House Planning Package). Niedrigenergie- und Passivhäuser, Published by Othmar Humm.



Figure 18 - First levels of concept, Agricultural facade

Architecture





3 Concept

3.1 Living in a city

Living starts at home before it starts in the city. That is why the quality of the housing is at least as important as the quality of the city, if not more.

Living in a city, but having advantages of a countryside life, is the most wanted feature in each residential complex. However, regulations on construction are much stricter and more complicated in urban areas and are mostly the result of very limited availability of free space.

Here it should be added that despite the less positive aspects of city life there is one highlight that earns a special status: the neighborhood and the social relations that define the quality of life in each residential complex.

My interpretation of a “mixed complex” is inspired by the “laager” life style¹¹. This concept interpreted in urban development today appears in the form of two arms turned to each other, protecting the area between the two. In this way, the two arms define the perception of the “inside” and the “outside”. A clear compromise between the introverted concept and its connection to the surrounding area, the existing city network, is presented here.

Controlled insight and avoidance of unpleasant interactions from the “outside” are the issues at stake here, especially since the complex is designated for a mixed used of residential, commercial and office purposes.

¹¹ The word is of South African origin, and originally referred to an encampment protected by a circle of wagons or armored vehicles.

3.2 Urban impact of the complex, developments

The architectural and urban concept consists of four main interconnected elements that embrace a green inner yard between them. Adding a fifth element in the center, a new semi-private inner yard is created. A main semi-public yard contains community and participation areas, as well as private gardens.

The development of the shape is designed to best fit the surroundings and to best fit the different demands of building – the residential, retail, and office functions. The main purpose of the design was to create a safe, introvert atmosphere in the midst of all other surrounding complexes in the neighborhood. At the same time a controlled connection to the city network and precise openings to the outside are present.

The parking is located underground with extra bike and stroller rooms placed in the underground levels close to the step cores.

An opening gap on the garage roof, which is located in the semi-private yard, provides the parking with fresh air and proper lighting. In addition to this gap, there is a second garage opening to the fresh air in the west side of the building (towards the outside of the building) where the wind intensity is the strongest in order to provide a natural air draft through the underground floors. The entire building site is closed to car traffic.



Figure 19 - concept: building blocks + green space + harmony & safety = perfection

4 Design process

4.1 Introduction, Project description

Today, working time accounts for the majority of time that an individual spends awake and leaves little time for other daily activities. Therefore, it is often hard to fit physical activities into the daily schedule. The complex “FIT FOR LIVING” with the site area of 10,900 m² (GFA) will facilitate daily physical activities, without regard to the season of the year, by providing recreational facilities in-house as well as in open-air. The easy access and almost zero waste of time will make physical activities extremely available for all occupants.

1. Office

- Office zone
 - Day-care center
 - Semi public gardens (Indoor)
 - Food court, coffee shop
 - Sport flagship store
 - Garage with natural air draft and day light
2. Residential

- Community rooms
 - Adults
 - Children (1 to 4 year)
 - Indoor
 - Outdoor
 - Sport
 - Swimming
 - Swimming pool (public)
 - Swimming strip (semi-public)
 - Gym
 - Running track
 - Yoga field
 - Volleyball court
 - Green roofs
 - Service rooms
 - Central bike room at the main entrance
 - Garden (relaxing)
 - Grass
 - Sand
 - Stone
 - Wood
3. Retail

- Shops
 - Copy shop
 - “Libro” shop
 - Bakery (“Anker”)
 - Video shop + Bookstore
 - Clothes shop (“H&M”)

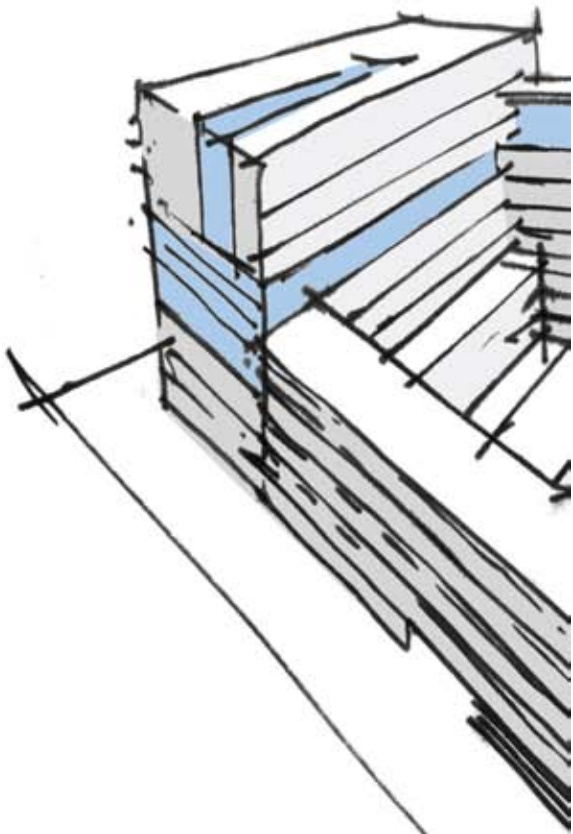
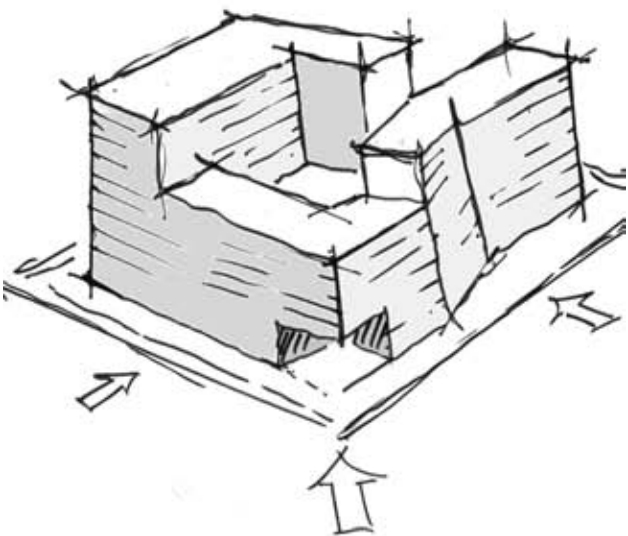
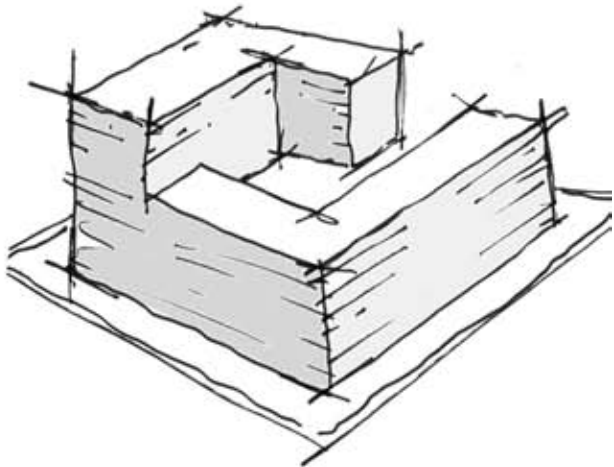
Optimum housing and proper planning according to the passive house system are represented. In order to be ecologically sustainable and to provide more financial benefits, natural air-conditioning as well as lower energy and water consumption is of great importance in this urban project. However, the motto here is low heat losses combined with solar and internal heat gains.

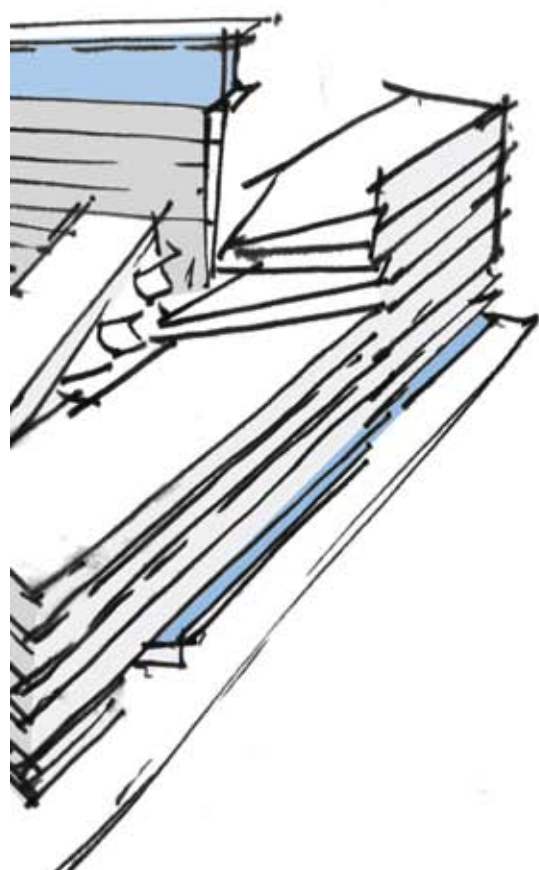
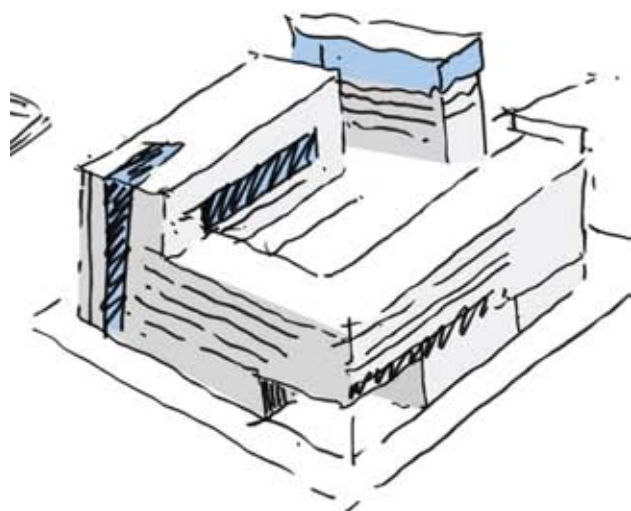
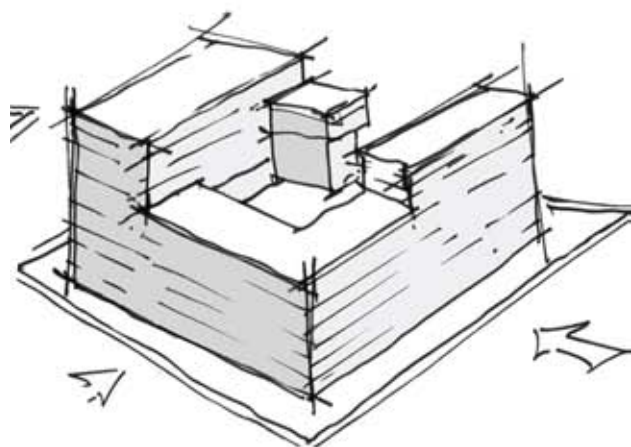
In addition to sport activities, vibrant residential and social networks in the living quarters are seen as an essential element of improved living quality. Good neighborly relations contribute to better social support as well as a greater feeling of safety by promoting integration within the residential area.

The complex is divided into three main functions of residential, retail and office. Leisure and recreational zones are spread throughout as an integral part.

The building features a new concept for making use of mechanical energy (the weight of vehicles plus the potential energy of water) and converting it in to electricity.(see: chapter energy concept)

A chart of the distribution of the functions gives a quick understanding of the complex. (see fig. Left, space program)





4.2 Target groups and objectives

The target group of this project is persons who are in the middle of their career life, young urban professionals, who beside their careers give great importance also to physical activities. It is also families with children who want to optimize their time and get out the most of the day both for themselves and for their children. The third target group of this building is senior citizens who are keen on preserving a relatively high level of social and physical activity. Especially to those who previously have had a high level of physical activity will find themselves at home in this complex.

The target groups are not just limited to the residential zone but also include workers in the office block, especially those with children and with an interest in physical activities.

The complex will offer activities such as jogging, swimming, fitness, yoga and others. It will also include an in-house daycare center, various children's playgrounds as well as a volleyball court. There will also be possibilities for lighter sport activities and for physical therapy. All sports and recreational facilities will also serve as social meeting points and will be an attraction for the entire neighborhood as well.

The retail zone with its dedicated functions will provide extra conveniences for the complex as a whole.

4.3 Public space - landscape architecture approach

"Einen Ort neu gestalten, das heisst auch eine Landschaft, die wir vielleicht nicht erkennen konnten, durch eine erkannte Landschaft zu ersetzen." (Bernard Lassus)¹²

"To design a new place means replacing also a landscape (image), which we maybe were not able to recognize, by a familiar landscape." (Bernard Lassus)

The pedestrian path that divides the inner yard in a semi-public and a private zone is at the same time giving the yard its characteristic shape. The presence of stone, wood, grass and sand in harmony is a treat for the eye and gives a special experience to the beholder recollecting a picturesque village society away from the urban stresses of today.

In order to create an energy efficient surrounding, big importance is given to the shaping of the landscape. The choice of plants for example has to be considered carefully. In addition to that, the water element has a great influence on the climate of the inner yard, especially in summer time. Combination of these two elements together with the wind will generate a passive air-cooling system and provide the yard and the surrounding units with fresh air and a pleasant atmosphere in the hot summer days.

¹² Warum ist Landschaft schön, Bernard Lassus, 2006

Sportsmen

Families:

- Singles
- Couples
- Big families
- Mother, child

Seniors

Employees

Lake (Pool)

Green house

Green zones

Swimming

Community roof

4.4 Joint use concept

Commonly used public spaces make a substantial contribution to social sustainability.

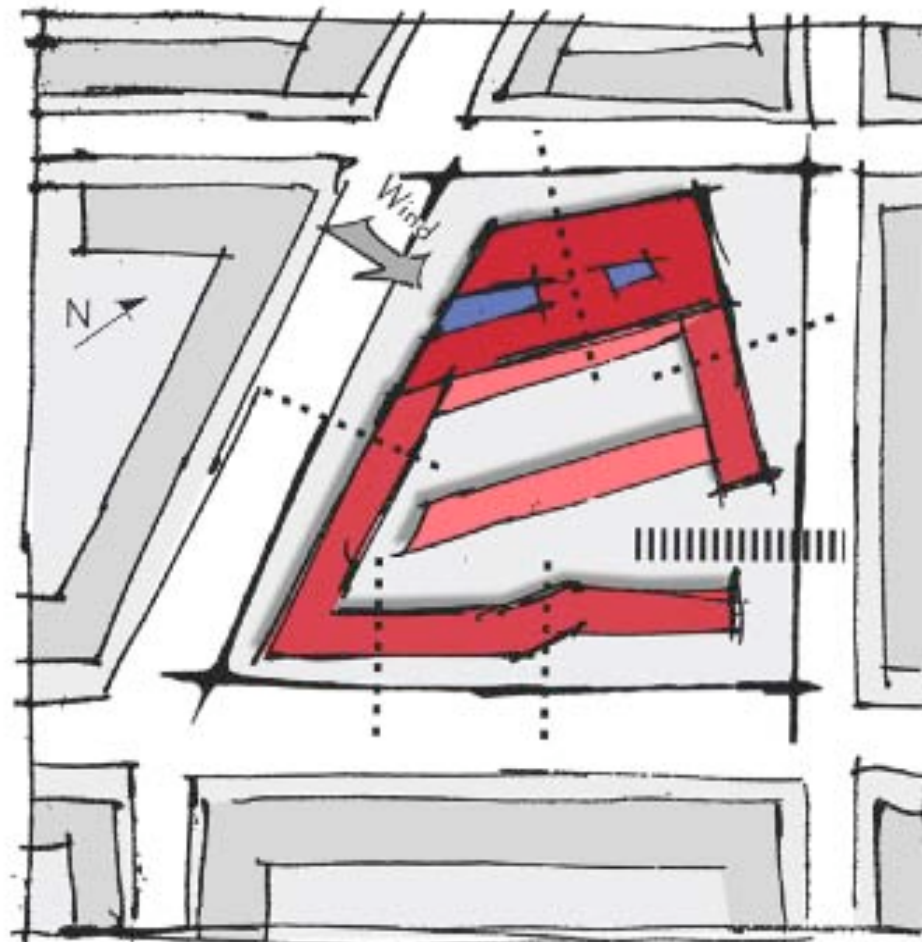
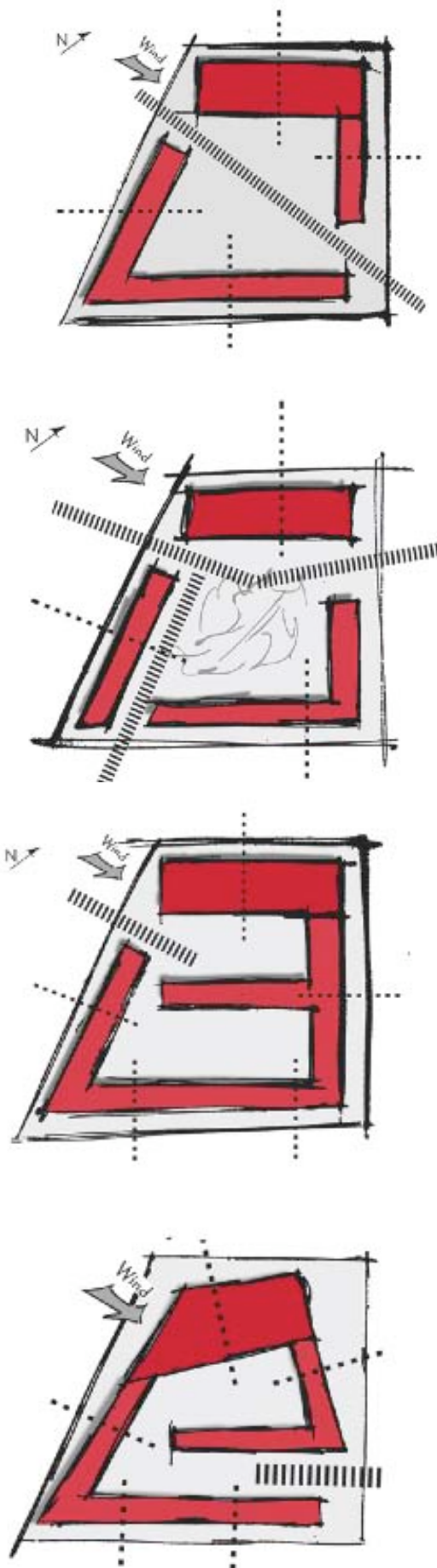
"Ich sehe den halböffentlichen Raum als einen Ort, wo man gewollt oder ungewollt, in Kontakt mit anderen Leuten, anderen Kulturen kommt und wo man im Gegensatz zur Konsumation aktiv am Geschehen teilnehmen kann." (Bart Brands)

"I see the semi-public spaces as a place, where you, whether you want it or not, come in contact with other people and other cultures, and where you, in contrast to consumption, can actively participate in the event. " (Bart Brands)"

The greenhouse at the top level of the residential block serves as an indoor park in the long winter season and is especially friendly to the elderly. There are also facilities dedicated to limited sports activities such as running path and yoga areas.

The entire roof surface is covered with green areas, which are more economical and ecological, and most of them are available to the residents and intended to be used as playgrounds.

The semi-public park inside the office block has been designed in order to soften the roughness of the office building and at the same time create better lighting and air circulation for the building. This green area also gives the opportunity to office workers with children to spend their lunch break with their children who spend their days in the nearby daycare center.



4.5 Orientation of the complex

Taking into account the wind conditions and the position of the sun throughout the year, as described above (see chapter 2.6), brings to the conclusion that the proposed orientation of the building is the most efficient position with regard to energy efficiency.

Figure number 21 shows the behavior of the sun in relation to the position of the building in the wintertime (with the blue line) and in the summer time (yellow line).¹³ This orientation will provide the different sides of the complex with optimal sunlight.

- This orientation in the planning allows the west-east oriented units to develop horizontally deeper than the other ones because of being supplied with proper daylight from both sides.
- The level shifts and voids on the facade will let the sun reach the inner side of the complex and provide the backside block with a better visual contact to the outside. They will also increase the interaction of the building with the surrounding area.

On the south side the building is designed to be lower in order to let the sunlight come through to the inner yard and to the higher parts of the building on the north and east side.

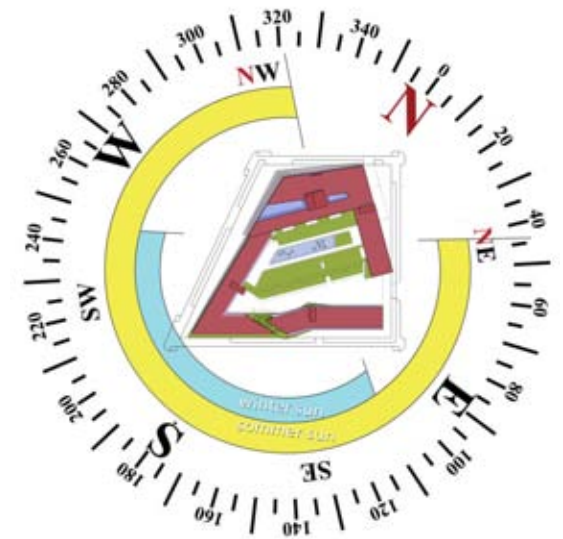


Figure 21 - Sun behavior at the site in winter and summer time respectively

4.6 Function zoning

Function zoning will increase the security level and at the same time the efficiency level of the complex. This sustainable complex contains three main parts with diverse functions spread throughout eight stories.

First, the residential parts with 14,900 m² (GFA) are presented as a passive house system. Most of the dwellings are north-south or southwest-northeast oriented and are reachable through loggias on the north and north-east side.

Second, the office block with 10,100 m² (GFA), designed in Combi-office system, is located in the northern side of the complex designed according to an energy efficient system. The gap in the office block will provide the office units with a better air and light supply. In addition to that utilization of sun protecting elements, etc. would all together characterize the office building façade.

Third, the retail zone with 1,500 m² (GFA) occupies most of the ground level in the residential block as well as the first two floors in the office block. The ground level will be kept mostly transparent or free as passageway to reduce the visual impression of a massive complex. The retail zone as well is designed according to an energy efficient system.

Along with these three functions, a recreational center with a gross floor area of 1,400 m² and a winter garden with 500 m² (GFA) are also presented here.

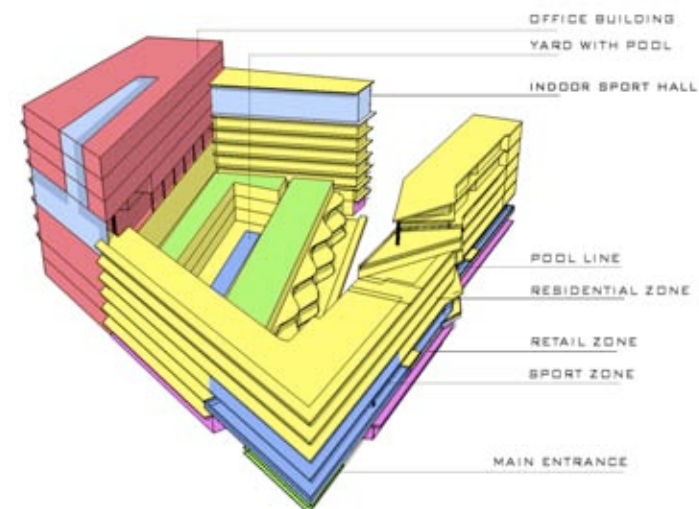


Figure 22 - Distribution of functions, isometric view

¹³ Steinhäuser Peter, Nordbahnhof Wien – Klima [05.10.2010]

4.7 Housing

Supplying the project with a large range of dwelling typologies such as studio apartments, maisonette apartments and lofts in different sizes, from 35 m² up to larger dwellings with an area of 135 m², will respond to the needs of single, couple and family households.

The total number of 109 dwellings, designed in eleven different typologies, is spread in the complex. Through out this distribution, the building envelop will be divided into five zones of A,B,C,D,F. (see fig. 24)

Loggias and balconies are carefully taken into consideration when developing the design not to disturb the exposure to natural lighting. To control the thermal exchanges the balconies are planned to be completely thermally separated from the building envelope.

Special features are the duplex flats on the ground level. These duplex flats will have optimal plans in order to minimize insight from the outside, increasing privacy for residents by placing the private zones on the second floor.



Figure 23 – 3D model, Main entrance to the residential zone

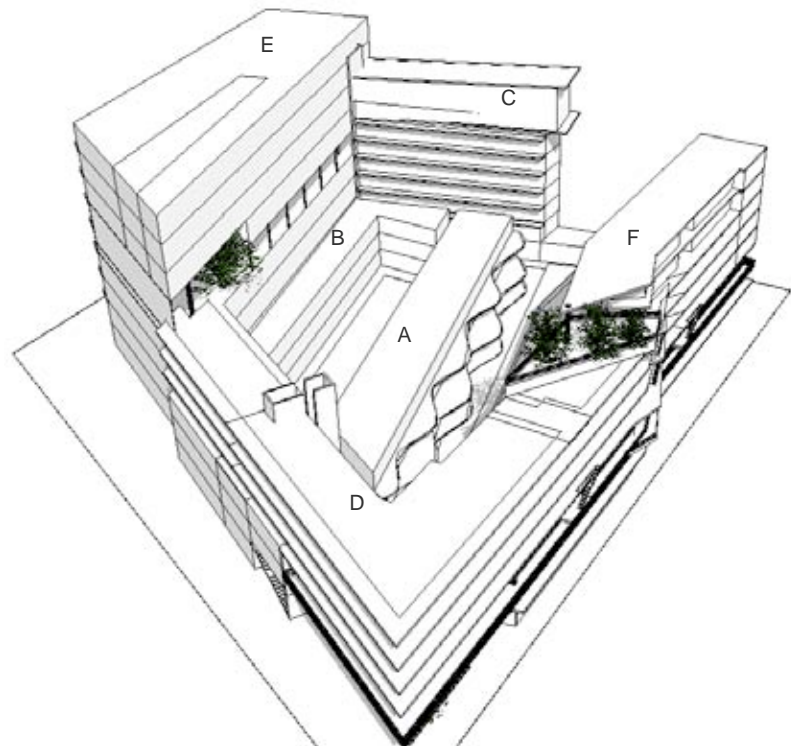


Figure 24 - 3D Model, Isometric view

Singles	1 Room dwelling	35-45 m2	35%
Seniors, Single parents, Couples/Flat share	2-3 Room dwelling	65-70 m2	8%, 20%, 7%
Family / Seniors	3-4 Room dwelling	80-100 m2	20%
Open Lifestyle	Penthouse	130 m2	10%

The motto: Keep the warmth inside!

The passive house lives up to its name by making extensive use of "passive" components which include heat-insulating windows, heat distribution systems in the heated space and above all, efficient thermal insulation to ensure that the warmth is kept inside.

Every person contributes with a calorific value of approx. 80 watts to heat up the interior. Considerable heat gains are realized through the windows, which in winter allow higher amounts of sun energy entering the house than the amount being lost to the outside.

With the heating energy recovered from the exhaust air, the expense incurred by a conventional heating system can normally be saved.

4.7.1 Common use of space – a contribution to social sustainability

"Heutzutage dürfte jedenfalls die Gesamte-Spieldauer im Freien im Durchschnitt aller Kinder merklich unter einer Stunde liegen." (Müller Zinn)¹⁴

"Nowadays, the average total playing time outdoor per child is significantly less than an hour." (Müller Zinn)

In each residential complex children and youth should be encouraged to spend most of their time in open air. For this reason there is a courtyard with a separate playground that includes a volleyball court, a children's playground, a sandbox, etc. Trying to keep noise levels down, the playground is located at the outer eastern side of the site, open on two sides in order to lead the noises off the site.

Green zones are distributed on different levels of the building, including the greenhouse that serves as a community room. This all increases the possibility and frequency of interaction between the residents and promotes vibrant neighborhood get-togethers.

Along with the usual community rooms, as well as different rooms for children, bikes and hobby activities, there are additional thematic facilities, which give the residents opportunities to meet and develop deeper social relations.

A common recreational pool that is shared between approximately 30 units is placed on the south side of the building along with the balconies of the respective sport units.

Not to forget different needs of children in different stages of their life, a second garden has been developed for children up to 4 years old. This garden, which is an additional part of the community room dedicated to the youngest ones, is more controlled and closed to the outside, letting parents feel more comfortable.

4.7.2 Leisure and recreation opportunities

For the sport-oriented singles and families, there are sport units with an additional option, the common recreational pool that is shared between all units. Along with the pool band there are some community joint points next to the stair cores, which allows the residence of other floors to reach the pool. The pool is placed on the southeast side along the balconies on the main façade.

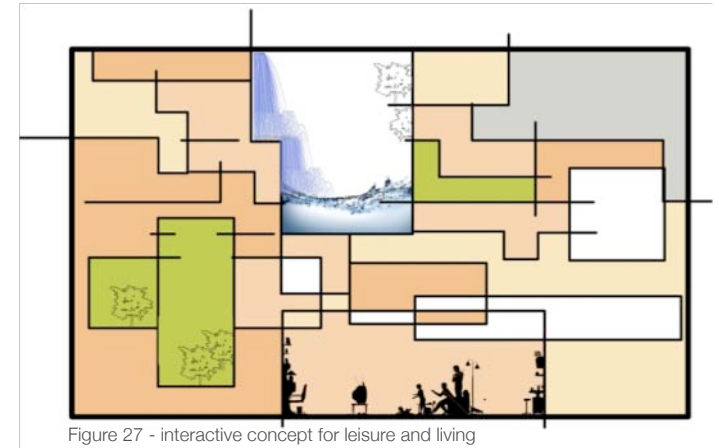


Figure 27 - interactive concept for leisure and living

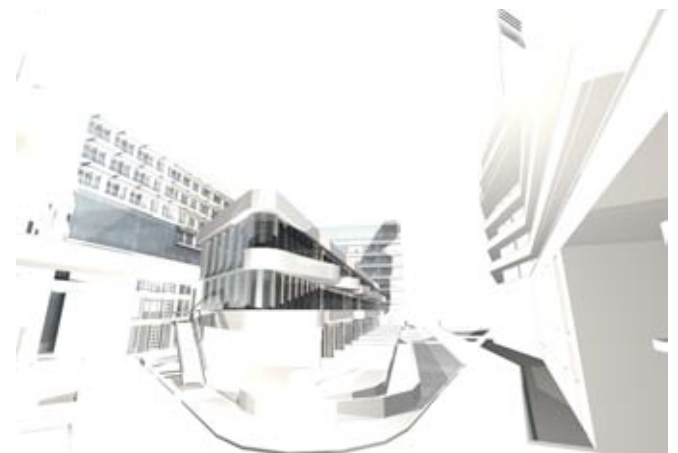


Figure 26 - View of inner semi-public yard



Figure 25 - View of the semi-private yard

¹⁴ Warum ist Landschaft schön, Bernard Lassus, 2006

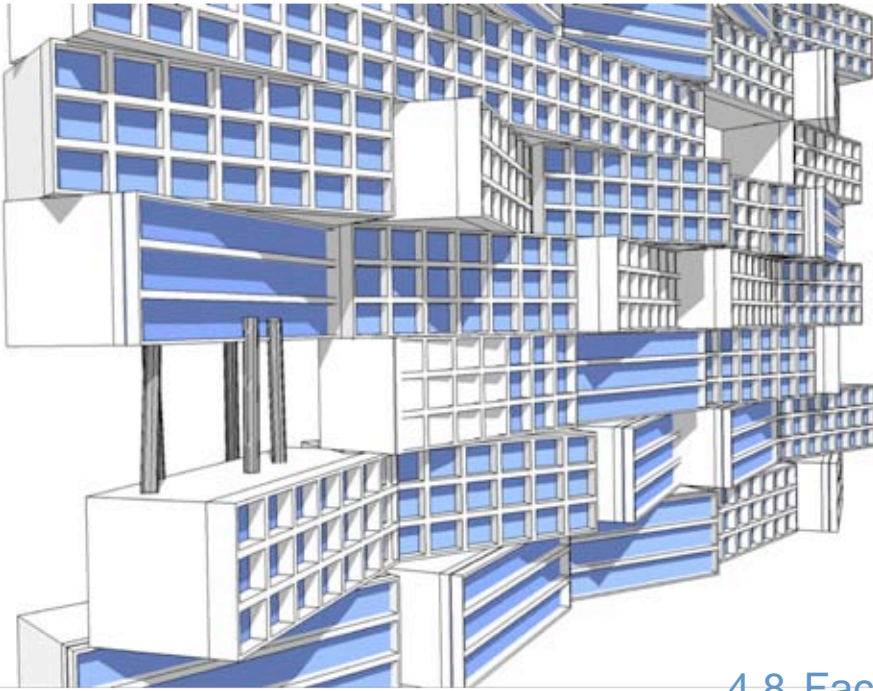


Figure 29 - First concept for the façade

4.8 Façade and interactions

The building has two distinct façades, the residential façade with a clear open façade controlled by adjustable sunshade elements, installed on the edge of the balconies and a transparent glass façade, characteristic for office buildings with massive double wing shaped sunshades attached outside of the building envelope. (see page 60)

Adequate triple glazing allows solar radiation to enter the interior and take effect as passive heat gain.

4.9 Environmentally friendly

The green land occupied by the building will be retrieved through green areas on different levels and balconies of the building. The "retrieval" of the green area is an effective method to reduce the negative effects of urbanization on nature.

The "white roof effect" and its impact on global warming, has been considered in choosing building materials on the facade of the complex to keep the building much cooler. This method reduces the amount of energy needed for ventilation and air-conditioning with approximately 10% to 20%. It reduces the so-called "heat island" effect, the heating up of entire urban areas which then causes other buildings in the vicinity to heat up, whether they are in direct contact with the sun or not. A white roof will actually reflect the sun's rays back into space, keeping the atmosphere cooler.¹⁵

Gardens with entertainment facilities in different levels are shared by residents of the complex and will also serve as a playground for younger children. The second yard is open also to visitors and is used as a meeting point as well as a playground for older children.

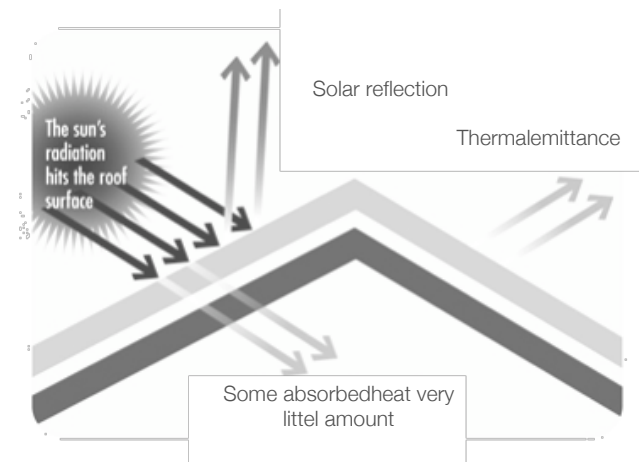


Figure 28 - White roof effect

¹⁵ Solar thermal technologies for buildings: the state of the art, Matheos Santamouris

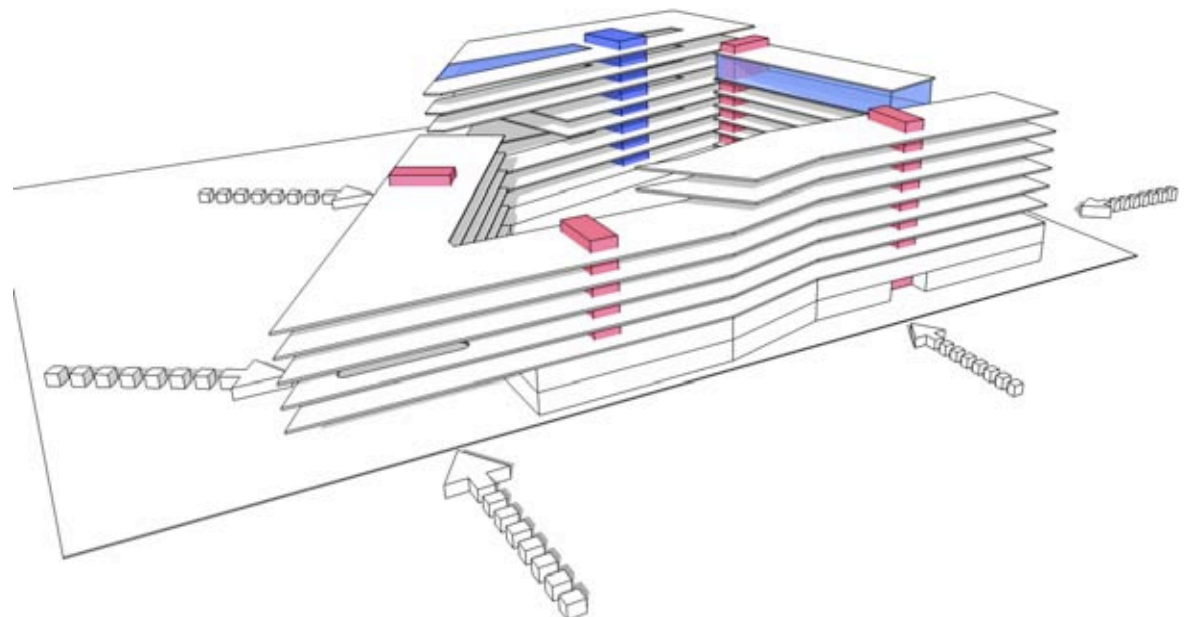
4.10 Vertical and Horizontal connections

The vertical transportation in the building is managed through five main vertical cores. These cores are open from one side in order to allow them to be considered also as emergency staircases.

For the security reasons there is a separate core running just between the office units and the garden on the 3rd floor apart from the residential cores.

The horizontal transportation in the residential zone is through open air corridors that are located on the inner side of the building.

Figure 30 - Vertical cores



Energy concept

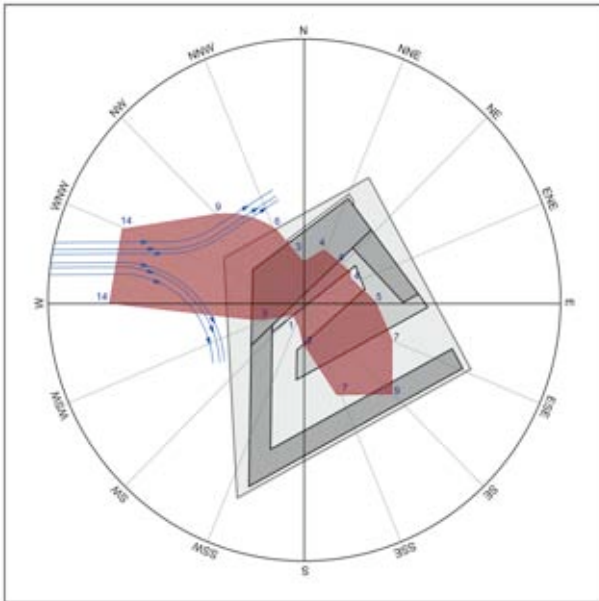


Figure 31 - Orientation of the complex

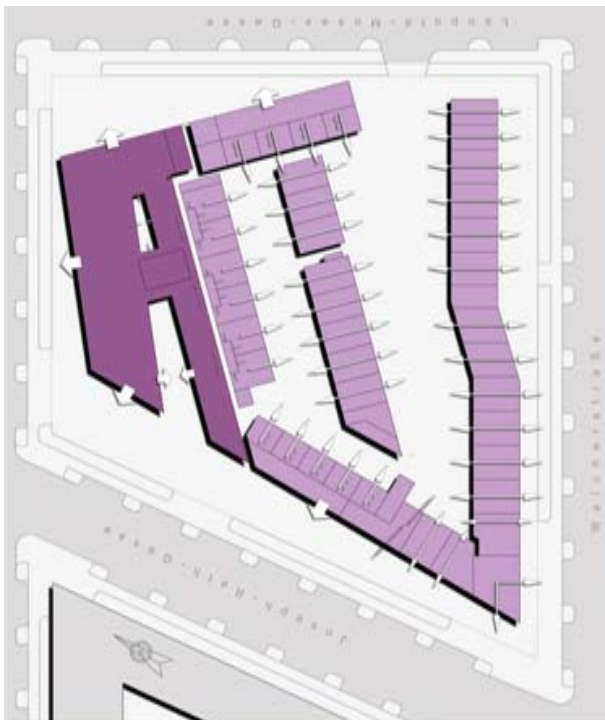


Figure 32 - Circulation of air and light for each unit

4.11 Energy concept

Orientation of the building according to the best sun and wind direction in order to provide the best natural lighting and air draft for the residential units will reduce extra costs of energy at the very first level.

The energy concept for the building is divided into two main parts of:

- **Housing**

Housing is a passive house standard – ventilation (mechanical) with heat recovery; openable windows however – district heating for heating support only in the transitional periods. Electricity for Ventilation is covered through PV. Warm water is supplied through Solar Panels on the roof.

- **Office**

Heating and cooling is done through geothermal energy (foundation) and heat pump; concrete core activation – openable windows for nightly cooling (with sensors) for automatic opening and closing

4.11.1 Solar energy

The Roof of block D, which is well connected to the residential blocks F, and has a direct connection to the open-air pool, provides the best location for accommodation of solar panels. (see fig. 24)

Sun collectors convert solar radiation into heat and transfer it to a carrier medium, which in this case is air. Afterwards, the converted solar heat can be utilized for producing domestic hot water. Warm water for the open-air pool (in winter time) is also considered here.

Photovoltaic (PV) modules are also seen here for electricity. The panels are installed at the top of the office block (E), which is indeed the highest block of the complex, not to be overshadowed by the neighboring buildings.



4.11.2 Innovation concept

Since the annual amount of rain in Austria is considerable, it is a good opportunity to extract the potential energy of collected water. The energy extracted could contribute significantly to the energy needs of the building.

By collecting the rainwater at the highest level of the building (top collection tank), releasing it and letting it pass the water wheels (installed in a separated duct next to the elevator duct), potential energy can be turned into efficient electricity to be used directly by the residents of the building.

By pumping up the fallen water from the bottom collection tank back to the top of the building, it will let the system work in a closed loop. A part of the energy needed to pump the water up would be supplied by the weight of vehicles entering the building. (see fig. 35 and 36)

The vehicles enter the building through a car elevator that in a normal situation is in balance with the water weight in the main vertical pipe. When vehicles are loaded onto the car elevator, the installed air pistons would slowly absorb the weight of the vehicle and let the vehicle reach the underground level of the garage.

The compressed air pistons will let the air pressure out into the air pressure tanks and press the water back up into the top collection tank. The water from the air pressure tanks is prevented to flow back into the bottom collection tank and can thus only push the water through the main pipe that leads up to the top collection tank.

The valves in the pressure tank are according to the piston valves system, open and closed when it is needed.

Of course, in this system, the vehicles are supposed to leave the building by using the regular exit ramp like in a normal garage.

The second system for pumping water is through the normal elevators by using the weight of the elevator cabin and the extra weight load. Every time the elevator cabin comes down it provides air pressure to the air pressure tank placed in the underground level, which consequently will pump water back up to the top collection tank. A similar process to inflating tires with an air pump.

The heavy elevator traffic in the office building makes this system more efficient.

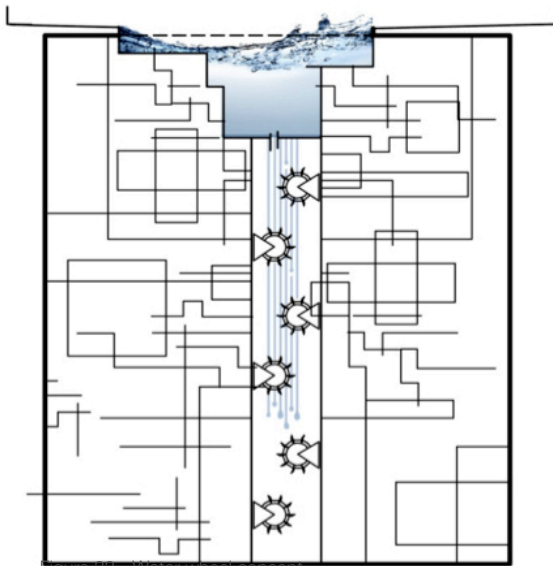
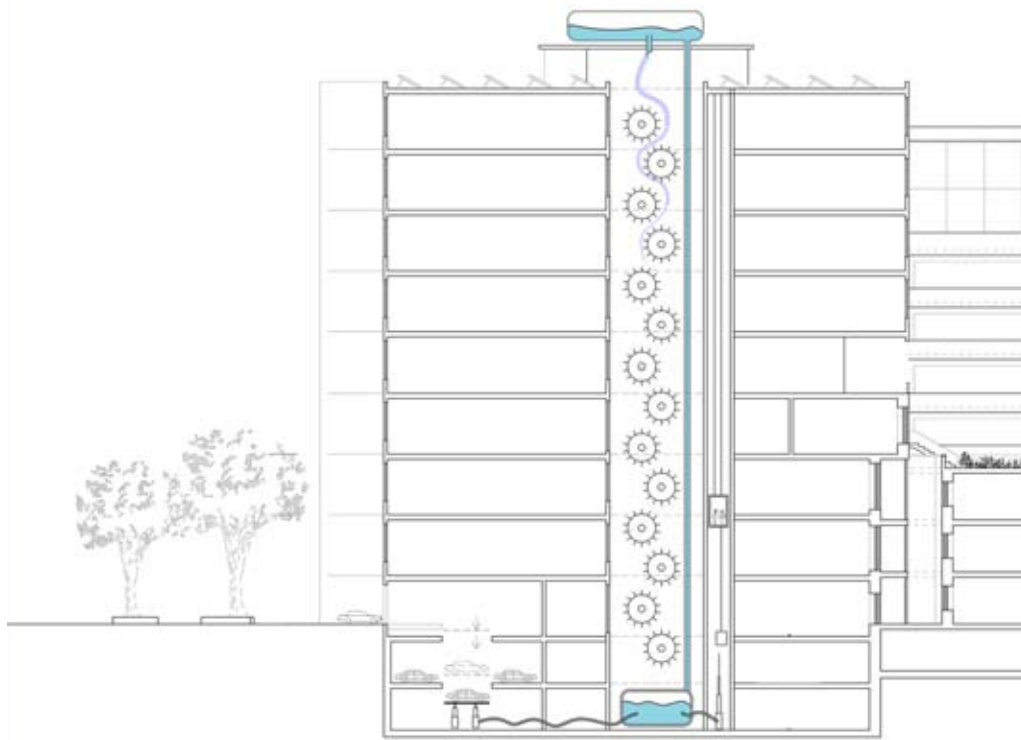


Figure 35 - Water wheel concept



Figure 34 - Air hydraulics



Water circulation by hydraulic air compressors / Air compressors
Figure 35 - Air pressure system by weight of the vehicles

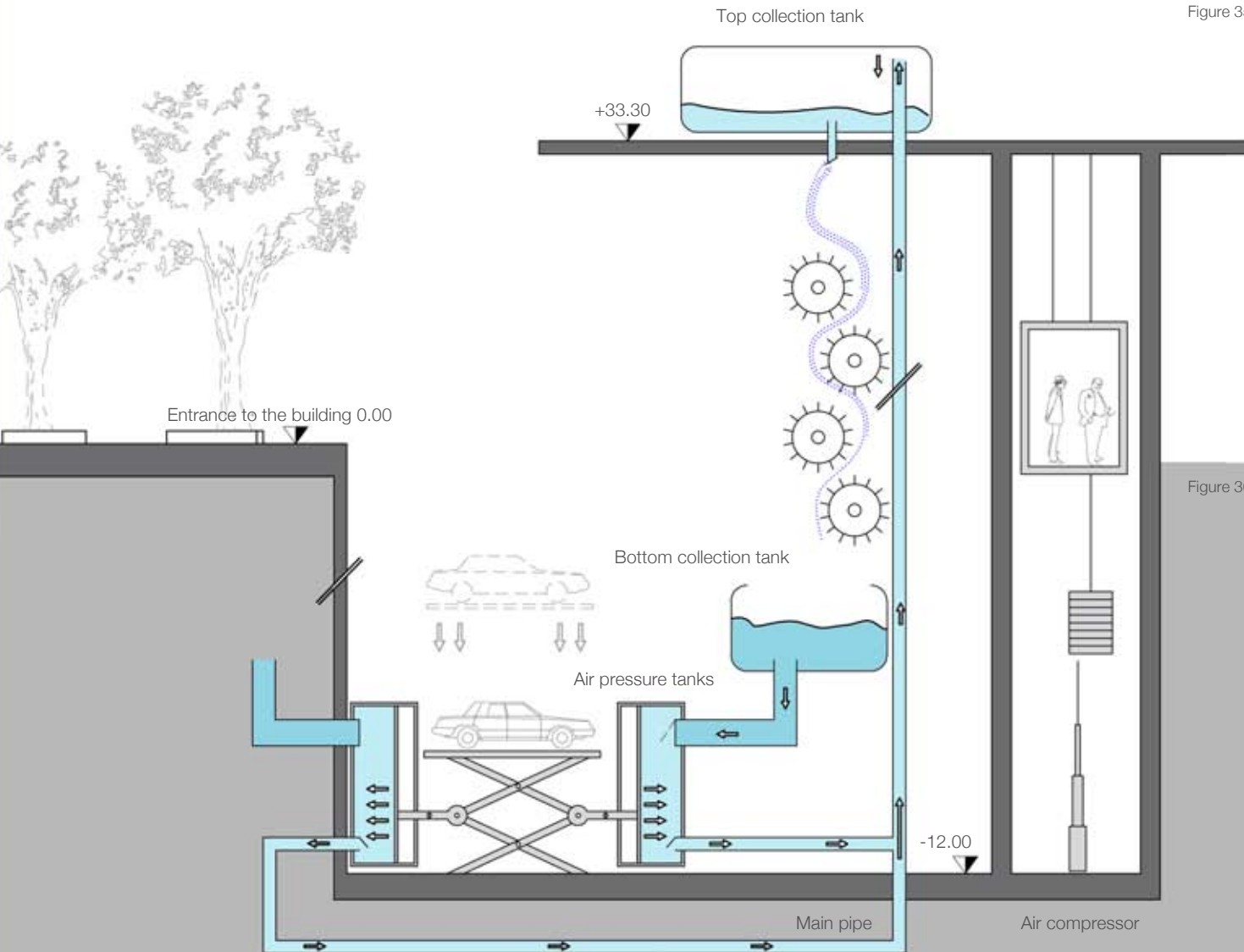
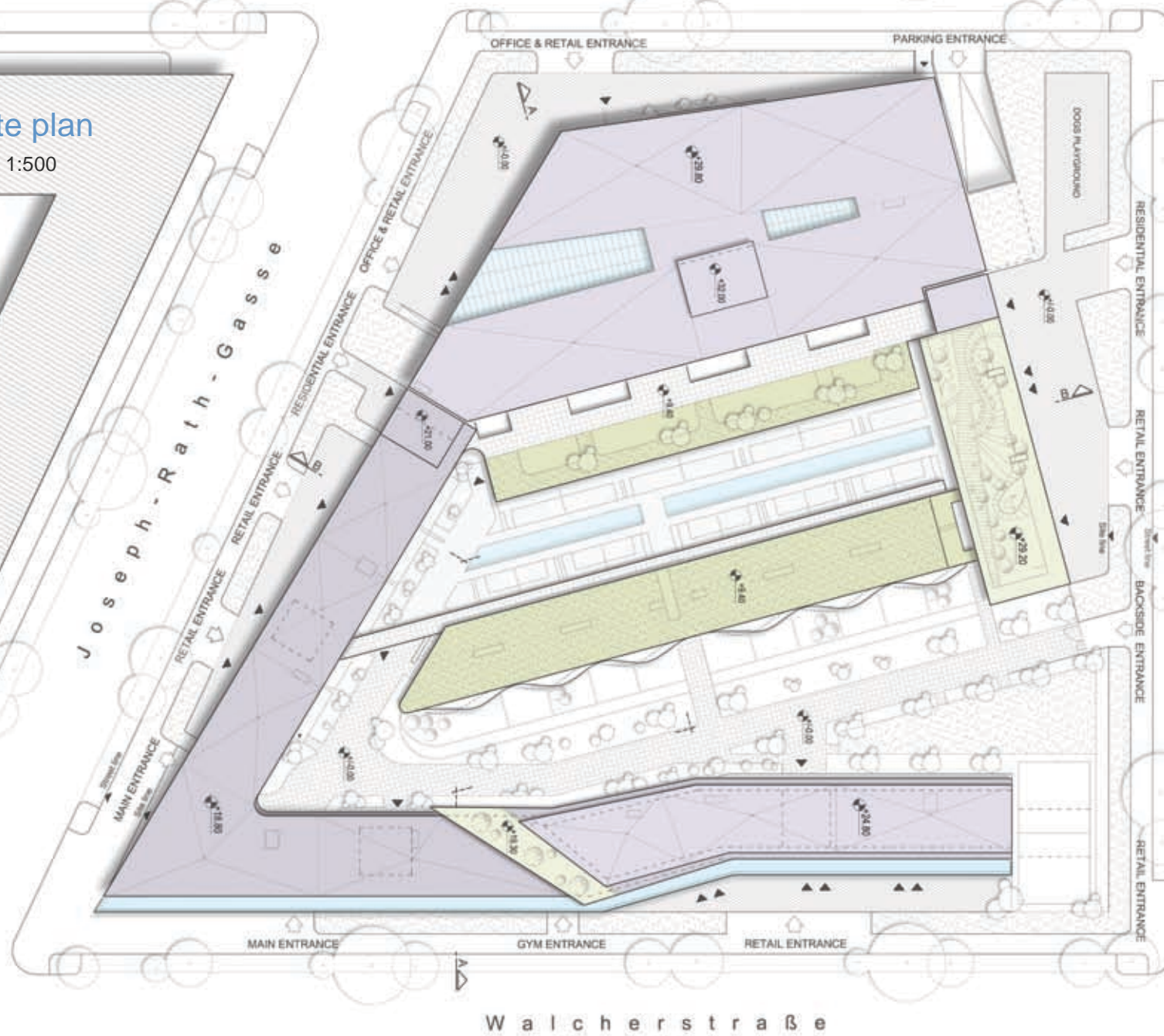


Figure 36 - Water wheel system

Design

5.1 Site plan

Sc. 1:500



5.2 Floor plans

Ground level

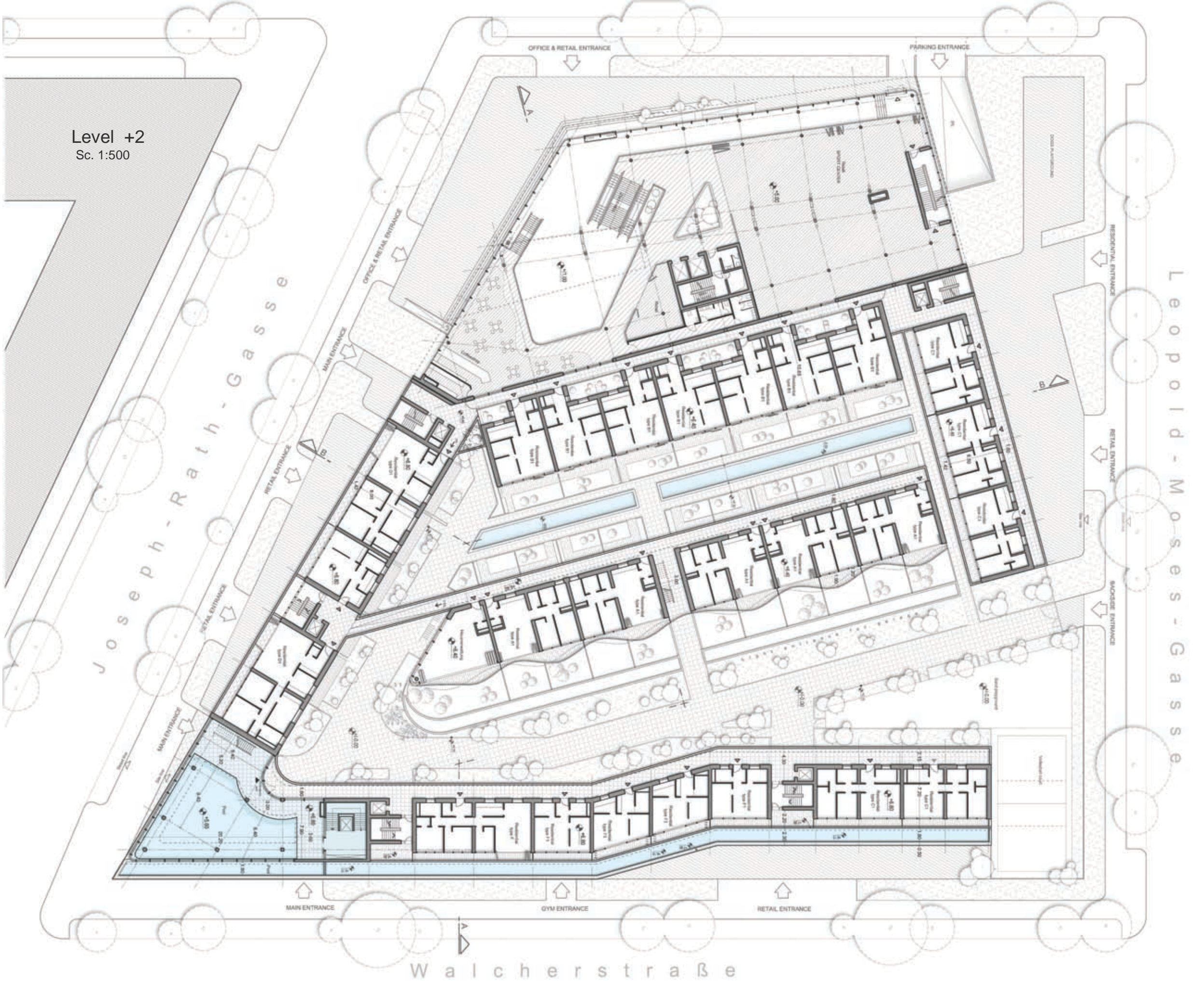
Sc. 1:500



Level +1
Sc. 1:500



Level +2
Sc. 1:500



Walcherstraße

Leopold-Moses-Gasse

Level +3
Sc. 1:500



Walcherstraße

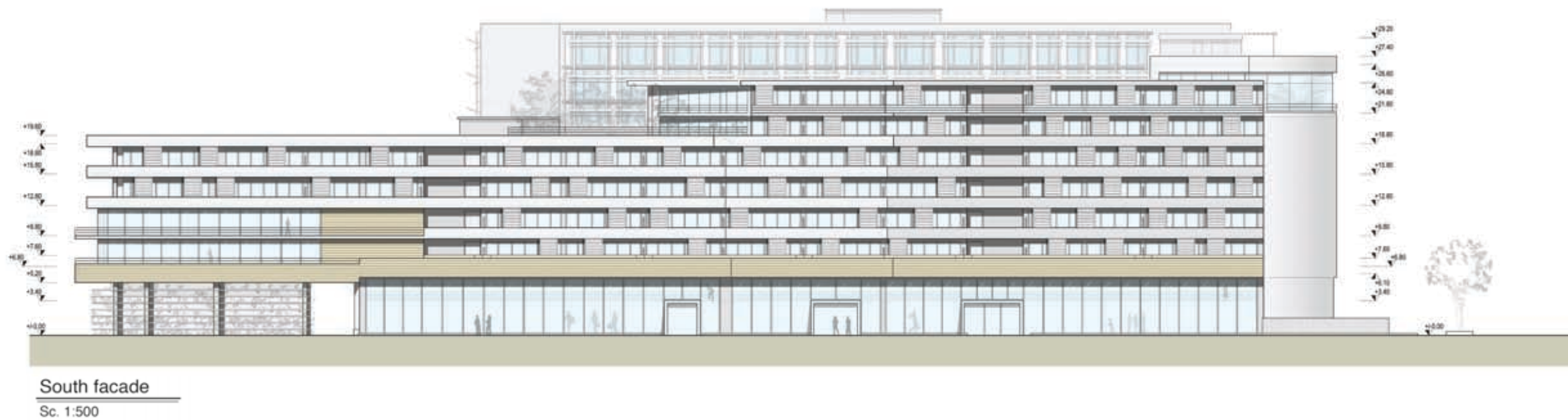
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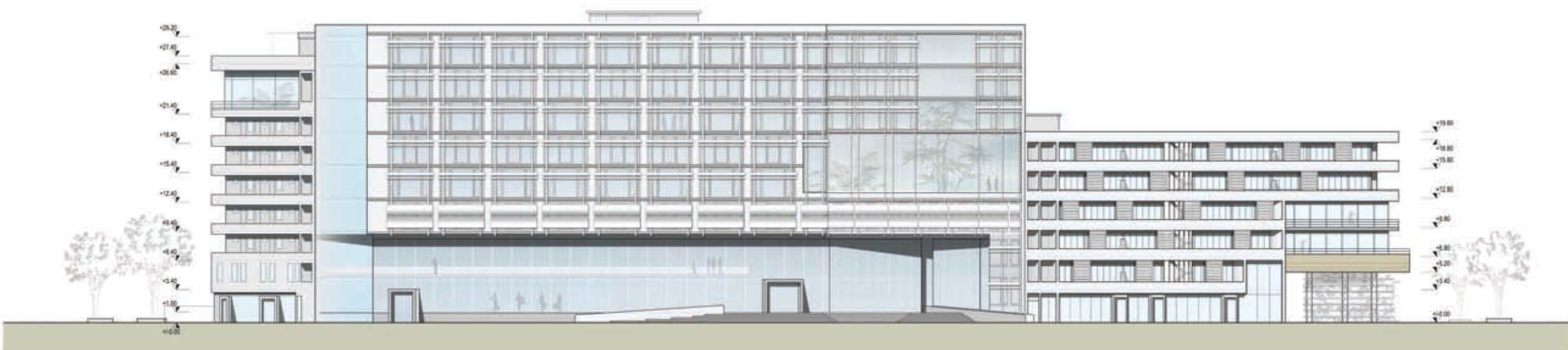
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Façades

5.3 Façades





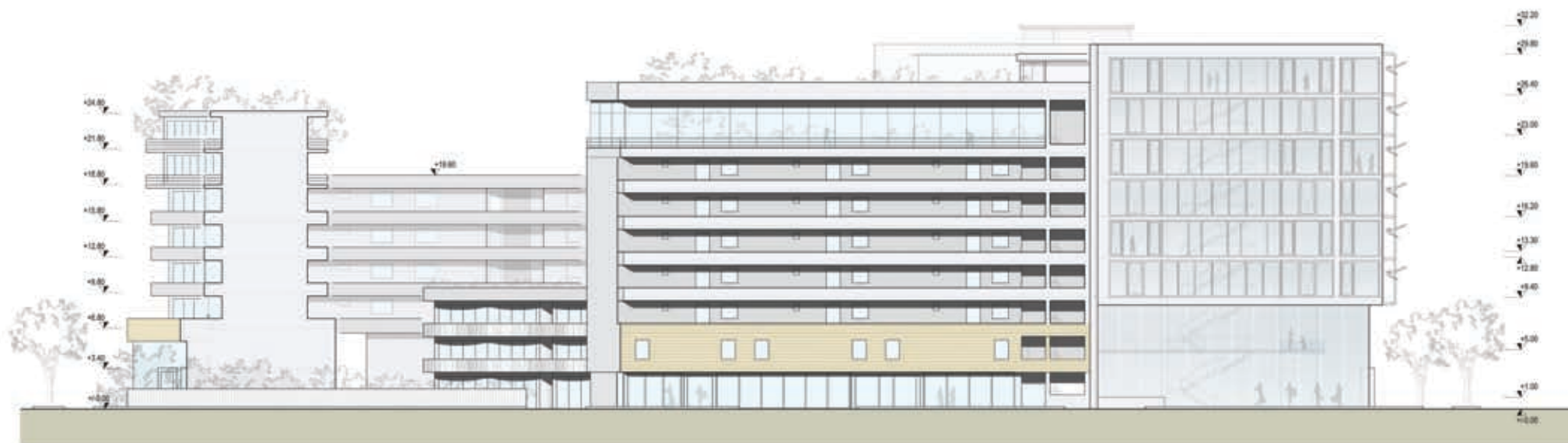
North facade

Sc. 1:500



West facade

Sc. 1:500



East facade

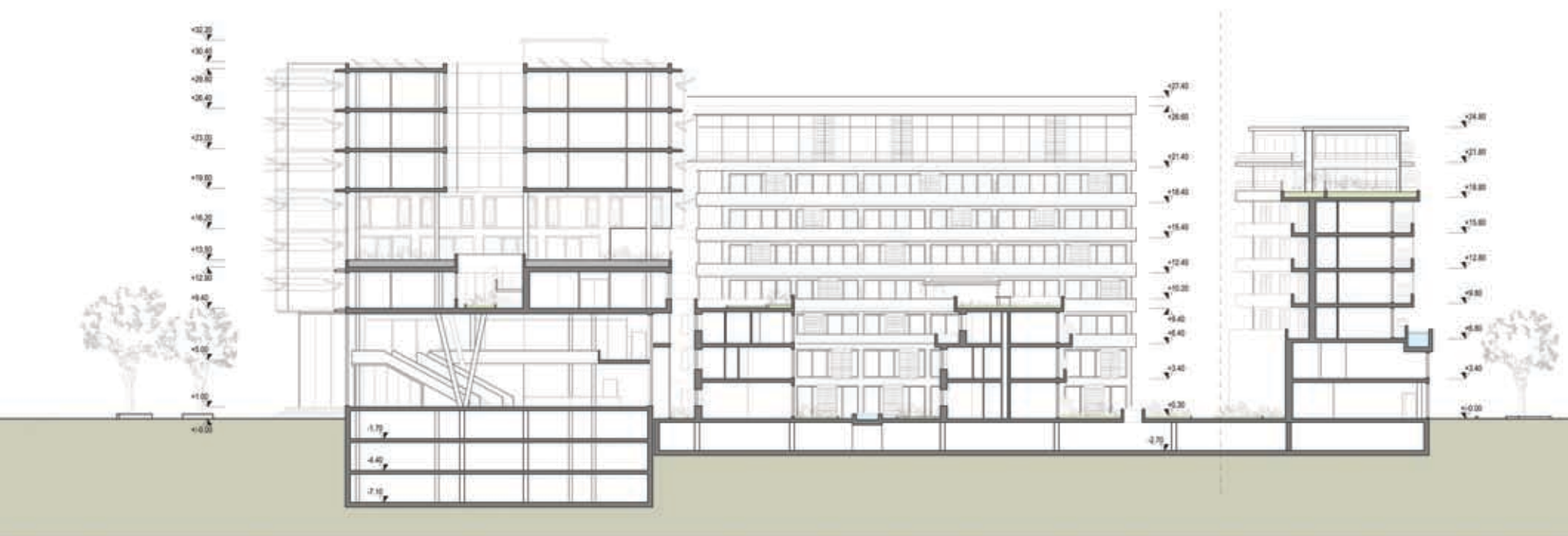
Sc. 1:500

5.4 Sections



Section B-B

Sc. 1:500



Section A-A

Sc. 1:500

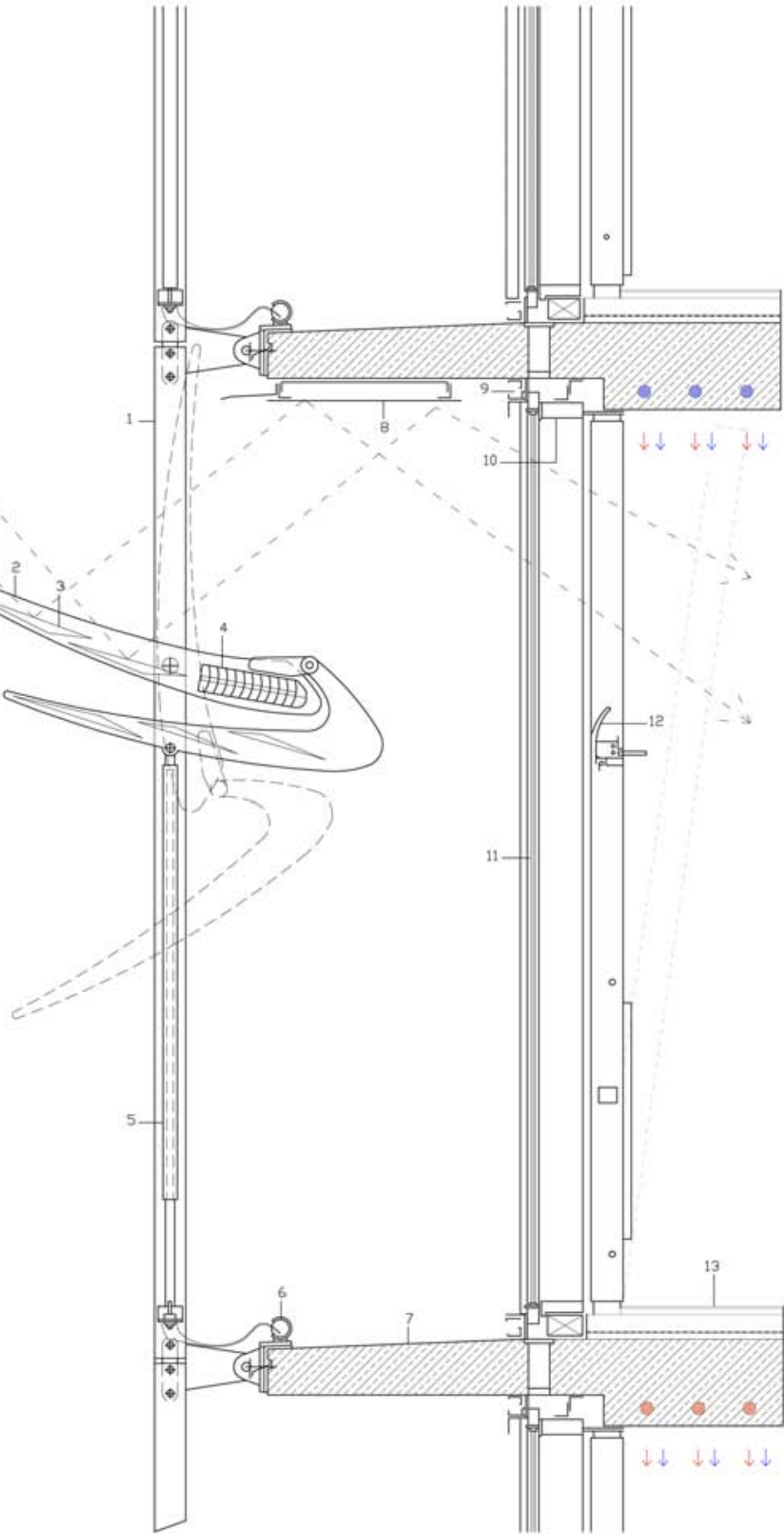
5.5 Details

Office building façade:

SC. 1:20

- 100/12 stainless_steel profile glass bead blasted finish
- powder-coated aluminium stirrup
- extruded aluminium profiles high-reflecting aluminium sheetfor indirect light reductin
- extruded aluminium profiles, high-reflecting aluminium sheet for direct light reductin
- spindle hoisting motor
- stainless-steel tube for cabling
- precast reinforced -concrete element with polyurethane coating
- aluminium light reflector
- facade sealing, extruded aluminium profile with EPDM sealing strip
- 50/150 mm hemlock frame, 5-fold bond
- triple-pane insulating glazing with powder-coated aluminium fixing strips
- light fixture with aluminium reflector, light-refracting glass pane and integrated anti-glare element
- floor constructio 20mm parkett / 60mm floating screed / barrier layer / 20mm impact sound insulation / 300mm reinforced concrete (Concrete Core Thermal Activation)

Figure 37 - windows format for office façade



Residential building detail section:

S1: Umkehrdach mit Begrünung (cm)

U-wert 0.22 W/m²k

1. 1.5 Pflanzensubstrat für intensive Begrünung
2. (im Randbereich Rundkies 16/32)
3. Filterschicht Vlies-Geotextil, unverrottbar
4. 5.0 Drainageschicht, Blähbetonschüttung 8/16
5. 18.0 XPS-G 30 S 18
6. 0.6 Wurzelschutzbahn
7. 0.8 Zweilagige Dach- und Abdichtungsbahnen, vollflächig berklebt oder geflämmt
8. Ausgleichsschicht, Bitmen-Lochglasvliesbahn
9. Voranstrich (Haftbrücke)
10. Gefällebeton mind. 2°
11. 20.0 Stahlbetondecke mit XPS-R 5 cm als Wärmebrückendämmung
12. brückendämmung
13. 1.5 Innenputz

S2: Wärmedämm- Verbundsystem mit Corblanit EPS-F Platte

(cm), U-wert 0.10 W/m²k

1. 1.5 Innenputz
2. 25.0 Hochlochziegel
3. 0.5 Klebeschichte
4. 30 Corblanit EPS-F 30
5. 0.2 Ausgleichsschichte
6. Aemierungsschichte mit mittig eingebettetem
7. Textilglasgitter mit Grundierung
8. Dünnschichtdeckputz

S3: Fußbodenheizung über Zwischengeschoßdecke

(cm), U-wert 0.45 W/m²k

1. 1.5 Fliesen
2. Fliesenkleber
3. 7.0 Heizestrich
4. 0.02 Isover Flammex, Dampfbremse
5. 6.0 Isover Trittschall-Dämmplatte TDPT 60
6. Trennschicht
7. 3.0 Gebundene Beschüttung
8. 18.0 Stahlbetonplatte
9. 0.5 Spachtelung

S4: Wärmedämm-Verbundsystem mit Corblanit EPS-F platte

(cm), U-wert 0.1 W/m²k

1. 1.5 Fliesen
2. Fliesenkleber
3. 2.0 Kalkzementputz
4. 25.0 Hochlochziegel
5. 0.5 Klebeschichte
6. 36.0 Corblanit EPS-F- 36 geklebt
7. 0.2 Ausgleichsschichte
8. 0.3 Aemierungsschichte mit mittig eingebettetem
9. Textilglasgitter mit Grundierung
10. 0.4 Dünnschichtdeckputz

S5: Fußbodenheizung über Keller

(cm), U-wert 0.1 W/m²k

1. 1.5 Fliesen
2. Fliesenkleber
3. 7.0 Heizestrich
4. 0.02 Isover Flammex, Dampfbremse
5. 14.0 Corblanit EPS-W 20 14
6. 6.0 Isover Trittschall-Dämmplatte TDPT 60
7. Trennschicht
8. 5.0 Gebundene Beschüttung
9. 16.0 Stahlbetondecke
10. 12.0 Isover Kellerdecken_Dämmplatte KDP 12

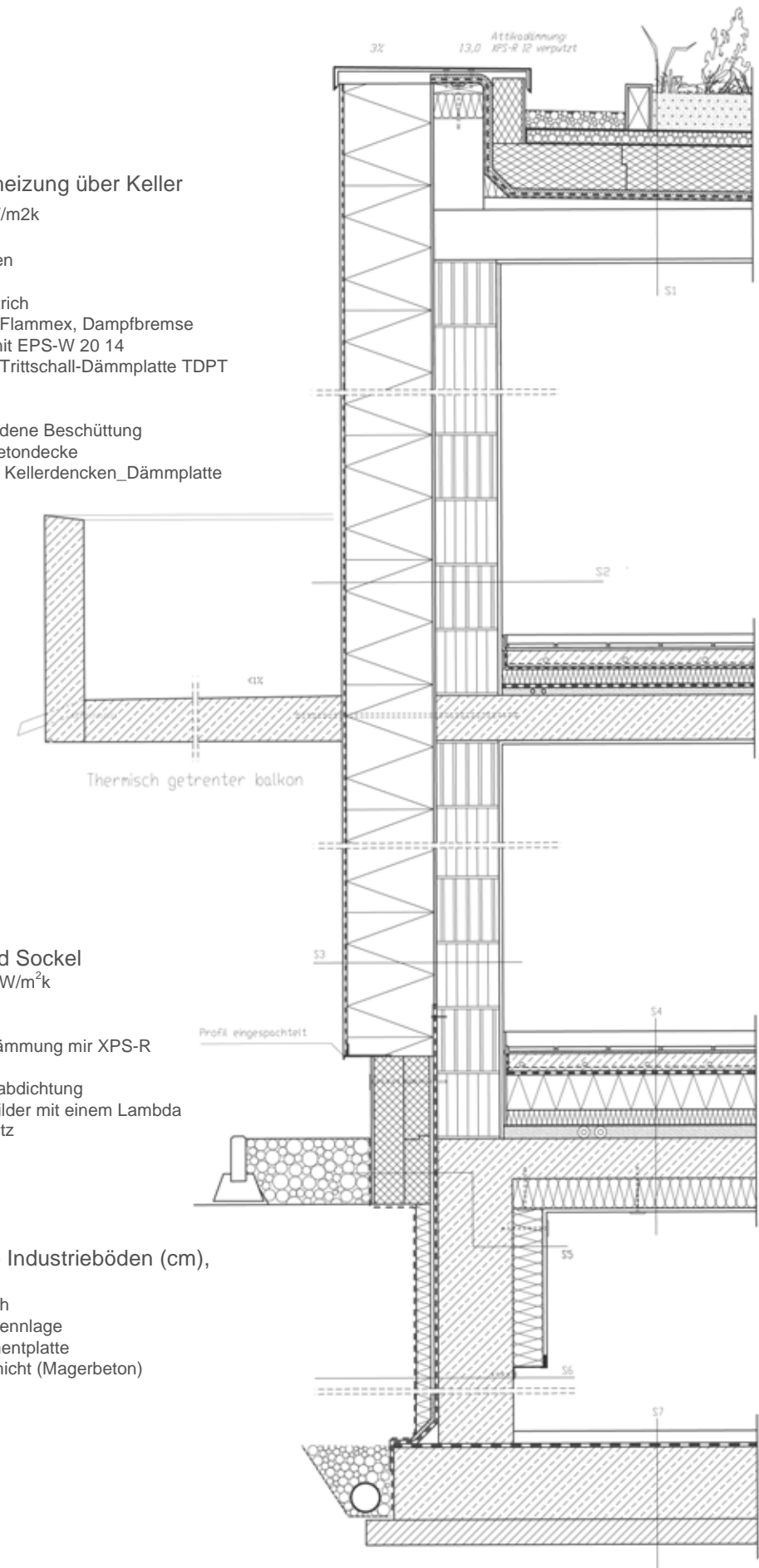
S6: Außenwand Sockel

(cm), U-wert 0.15 W/m²k

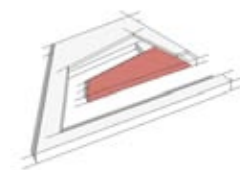
1. Deckschichte
2. 24.0 Sockeldämmung mir XPS-R (zweilagig)
3. Feuchtigkeitsabdichtung
4. 20.0 Wandbilder mit einem Lambda
5. 1.5 Innenputz

S7: Befahrbare Industrieböden (cm),

1. 10.0 Eistrich
2. Baufolie als trennlage
3. 30.0 Fundamentplatte
4. Sauberkeitschicht (Magerbeton)

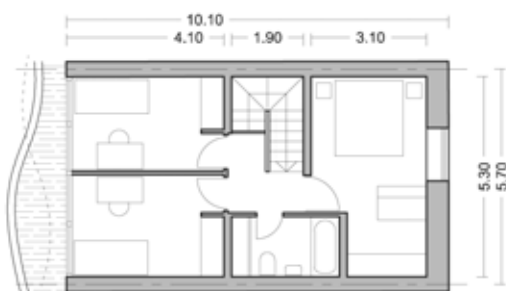


5.6 Dwelling typologies



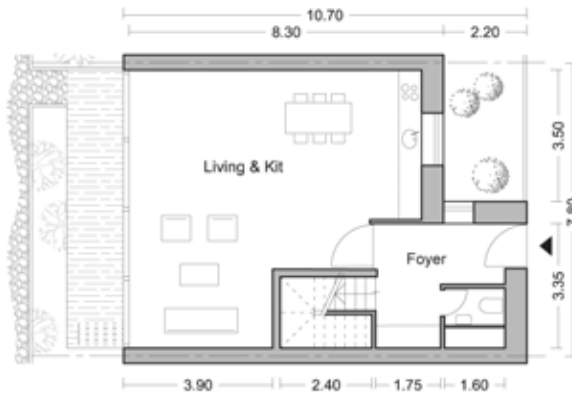
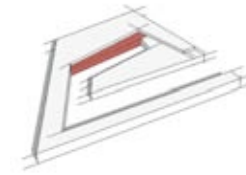
TYP A
Family / Seniors 3-4 Room dwelling
Sc. 1:200

BGF	101.00m2
NGF	96.00
Living room	22.40m2
kitchen	11.30M2
Sleeping r.	14.50M2
Sleeping r.	10.90M2
Sleeping r.	10.20M2
WC room	2.20+4.50M2



TYP A.1
Family / Seniors 3-4 Room dwelling / Flat share
Sc. 1:200

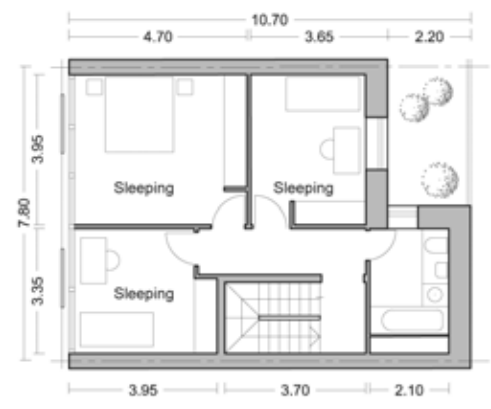
BGF	87.50 M2
NGF	81.40M2
Living & Kitchen	33.00M2
Sleeping r.	9.60M2
Sleeping r.	8.90M2
WC room	5M2+1.40M2



TYP B
Family / Seniors 3-4 Room dwelling
Sc. 1:200

BGF 132.00m²
NGF 122

Living room & kit 47.40M²
Sleeping r. 18.20M²
Sleeping r. 12.10M²
Sleeping r. 10.80M²
WC room 5.80M²

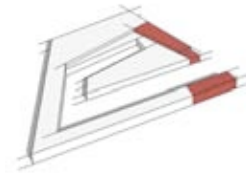


TYP B.1
Singles / Couples
Sc. 1:200

BGF 63.5
NGF 62

Living room 26M²
Sleeping r. 9.80M²
Kitchen 7.80M²
WC room 4M²





TYP C

Singles / Couples
Sc. 1:200

BGF 63.3
NGF 61.2

Living room	12M2
Sleeping r.	15M2
Kitchen	13.5M2
WC room	4.5M2

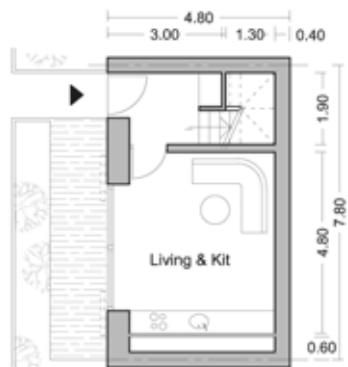
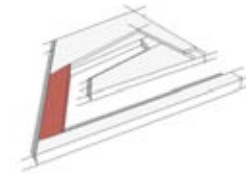


TYP C.1

Family / Flat share
Sc. 1:200

BGF 82m2
NGF 66.80m2

Living room	25.00M2
Sleeping r.	14.50M2
Sleeping r.	9.00M2
Kitchen	6.50M2
WC room	5.50M2

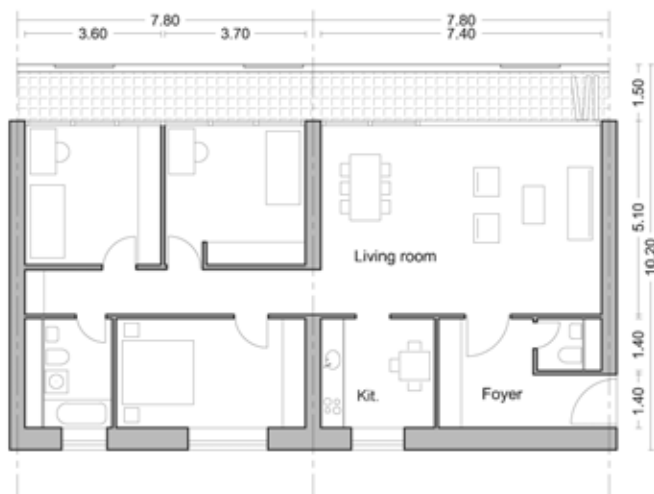


TYP D

Family / Couples / Flat share
Sc. 1:200

BGF 95.00m²
NGF 85.40m²

Living room 20M²
Sleeping r. 13.30M²
Sleeping r. 11.70M²
Kitchen 22.50M²
WC room 4.40M²

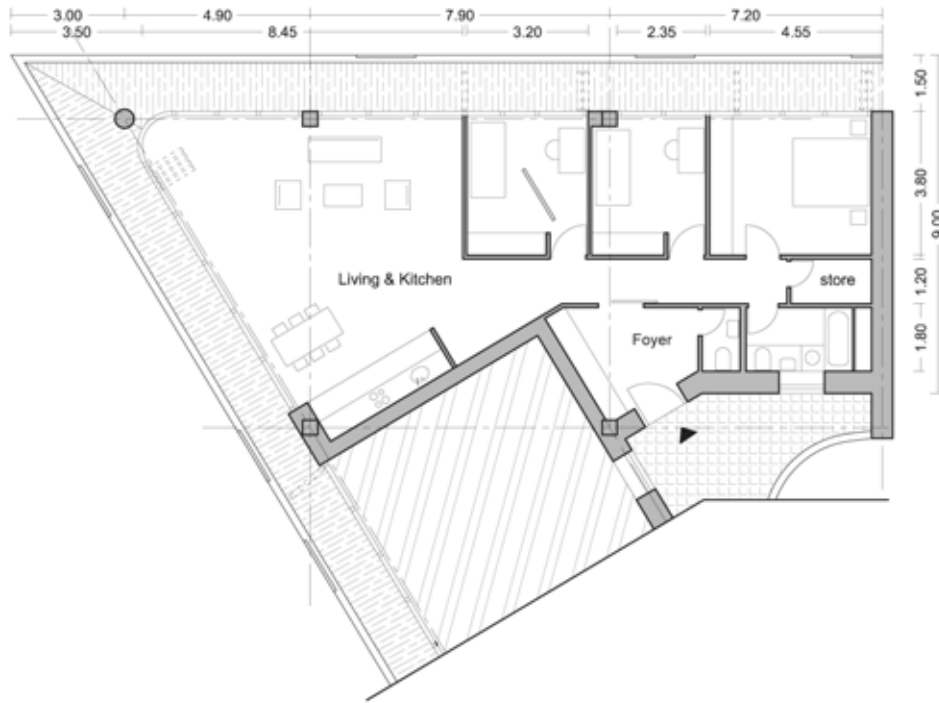
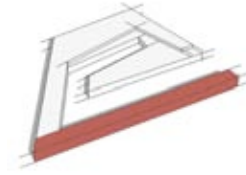


TYP D.1

Family / Flat share
Sc. 1:200

BGF 133.80m²
NGF 112.20m²

Living room 37.20M²
Sleeping r. 14.50M²
Sleeping r. 13.70M²
Sleeping r. 13.20M²
Kitchen 8.70M²
WC room 2.40 + 5.20M²
Foyer 9.80M²

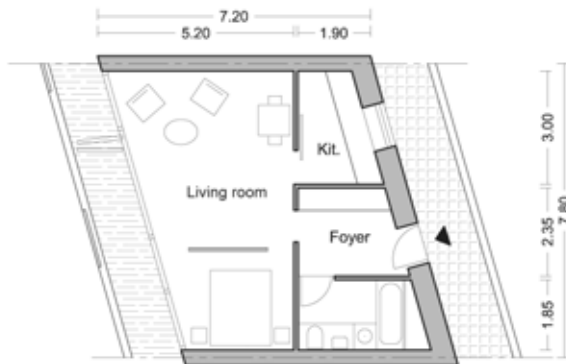


TYP F.2

Open Lifestyle
Sc. 1:200

BGF 134.50 M2
NGF 120.50M2

Living r. & Kitchen	56.40M2
Sleeping r.	15.50M2
Sleeping r.	12.20M2
Sleeping r.	11.50M2
WC room	4.80M2- 2.5M2
Store	2.80M2
Foyer	8.50



TYP F3

Single / Couples
Sc. 1:200

BGF 54.50 M2
NGF 46.30M2

Living r.	21.40M2
Kitchen	8.20M2
Sleeping r.	9.80M2
WC room	4.80M2
Foyer	6.20



TYP F

Family / Seniors 3-4 Room dwelling

BGF 100.50 M2
NGF 92.5M2

Living r.	31M2
Kitchen	7.40M2
Sleeping r.	14M2
Sleeping r.	12.0M2
Sleeping r.	8.30M2
WC room	5.10M2- 2.2M2
Foyer	5M2



TYP F.1

Singles/Couples

BGF 47.5
NGF 46.5

Living room	22M2
Sleeping r.	12M2
Kitchen	5M2
WC room	4M2

5.7 Energy certificate

Energy certification for the block A, the three floor block in the inner yard.

GZ
2008-1234 56

Musterbüro
Abteilung für Energieausweisstellung

EA
Seite 1/20

Energieausweis für Wohngebäude

gemäß ONORM H 5050
und Richtlinie 2002/91/EG

EXCEL
Schulungs-
Tool

GEBÄUDE

Gebäudeart: Mehrfamilienhaus

Erdbau:

Gebäudezone: Nordbahnhof

Katastralgemeinde:

Strasse: Walcherstraße

KG-Nummer:

PLZ/St: 1020 Wien

Eintragsort:

Eigentümer:

Grundstücknummer:

SPEZIFISCHER HEIZWÄRMEBEDARF bei 3400 HEIZGRADTAGEN (REFERENZKLIMA)

A++

A+

A

B

C

D

E

F

G

13,83 kWh/m²a

ERSTELLT

Erstellt:

Erstellt von:

GWR-Zust:

Geschäftszeit:

Organisation:

Datum: 2/23/11

Gültigkeit: keine

Unterschrift:

Dieser Energieausweis entspricht den Vorgaben der Richtlinie 9 "Energieeffizienz und Wärmeschutz" des Österreichischen Instituts für Bautechnik in Umsetzung der Richtlinie 2002/91/EG über die Gesamtenergieeffizienz von Gebäuden und des Energieausweis-Vorlage-Gesetzes (EAVG).

GZ
2008-1234 56

Musterbüro
Abteilung für Energieausweisstellung

EA
Seite 2/20

Energieausweis für Wohngebäude

gemäß ONORM H 5050
und Richtlinie 2002/91/EG

EXCEL
Schulungs-
Tool

GEBÄUDEDATEN

Brutto-Grundfläche: 936.00 m²

beheiztes Brutto-Volumen: 2808.0 m³

charakteristische Länge (lc): 2.06 m

Kompaktheit (AV): 0.49 1/m

mittlerer U-Wert (Uw): 0.27 W/m²K

LEA-Wert: ---

Brutto-Grundfläche: 748.80 m²

KLIMADATEN

Klimaregion: N

Seehöhe: 150 m

Heizgradtage: 3438

Heiztage: 148

Nom.-Außentemperatur: -13 °C

Soll-Innentemperatur: 20 °C

WÄRME- und ENERGIEBEDARF

Referenzklima

spezifisch

Standardklima

spezifisch

Anforderung

HWS

12567 kWh/a

13.43 kWh/m²a

13289 kWh/a

14.20 kWh/m²a

51.3 kWh/m²a (erfüllt)

WWWS

11957 kWh/a

12.78 kWh/m²a

HTES-ht

28611 kWh/a

30.57 kWh/m²a

HTES-ww

8670 kWh/a

9.26 kWh/m²a

HTES

37281 kWh/a

39.83 kWh/m²a

HEB

62528 kWh/a

66.80 kWh/m²a

105.9 kWh/m²a (erfüllt)

EEB

62528 kWh/a

66.80 kWh/m²a

PEB

CO2

ERLÄUTERUNGEN

Heizwärmebedarf (HWS): Vom Heizsystem in die Räume abgegebene Wärmemenge, die benötigt wird, um während der Heizperiode bei einer standardisierten Nutzung eine Temperatur von 20 °C zu halten.

Heiztechnikenergiebedarf (HTES): Energiemenge, die bei der Wärmeabgabe, -verteilung, -speicherung und -bereitstellung für Raumwärme und Warmwasser verloren geht.

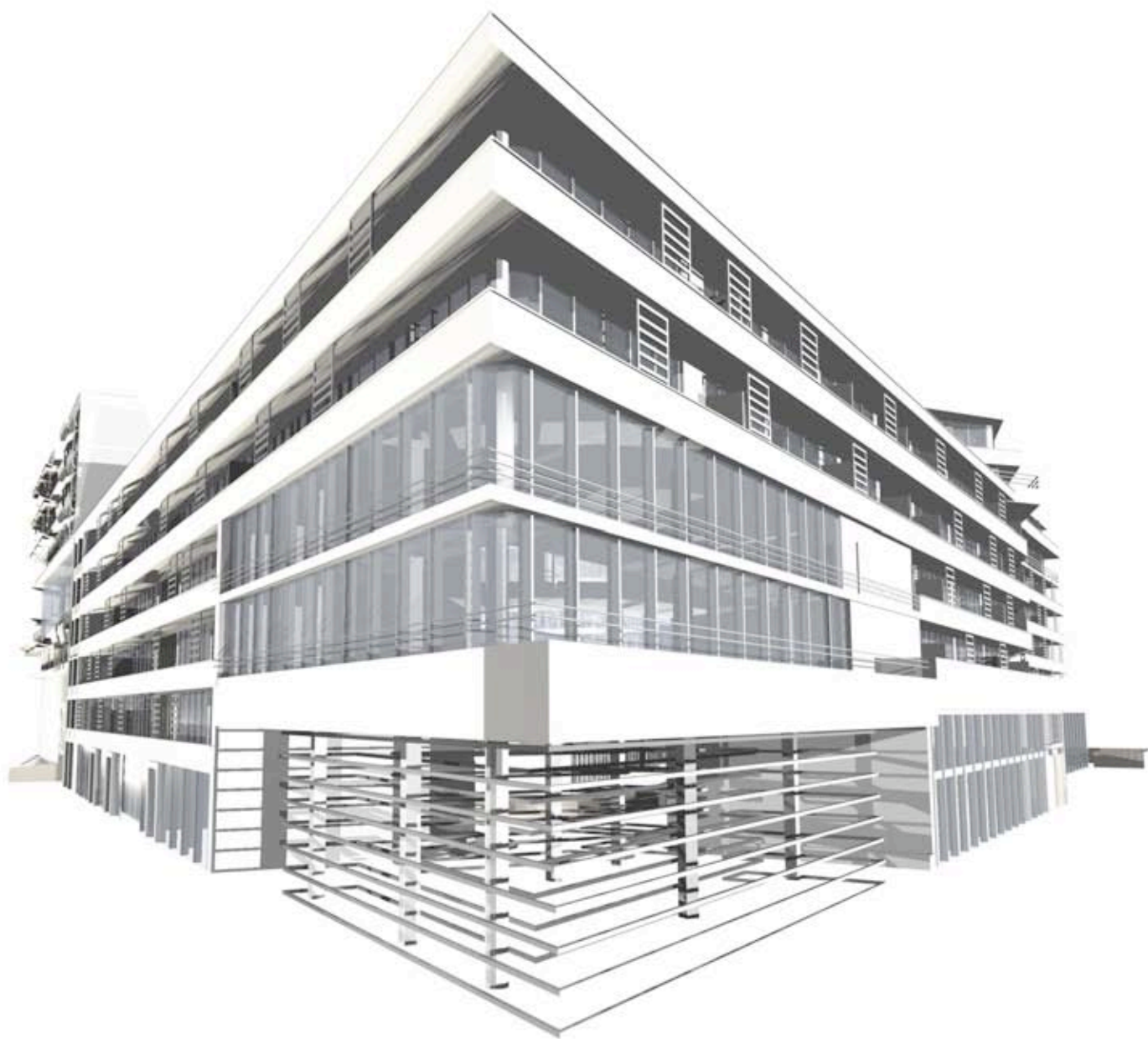
Endenergiebedarf (EEB): Energiemenge, die dem Energiesystem des Gebäudes für Heizung und Warmwasserversorgung inklusive notwendiger Energiemengen für die Hilfsbetriebe bei einer typischen Standardnutzung zugeführt werden muss.

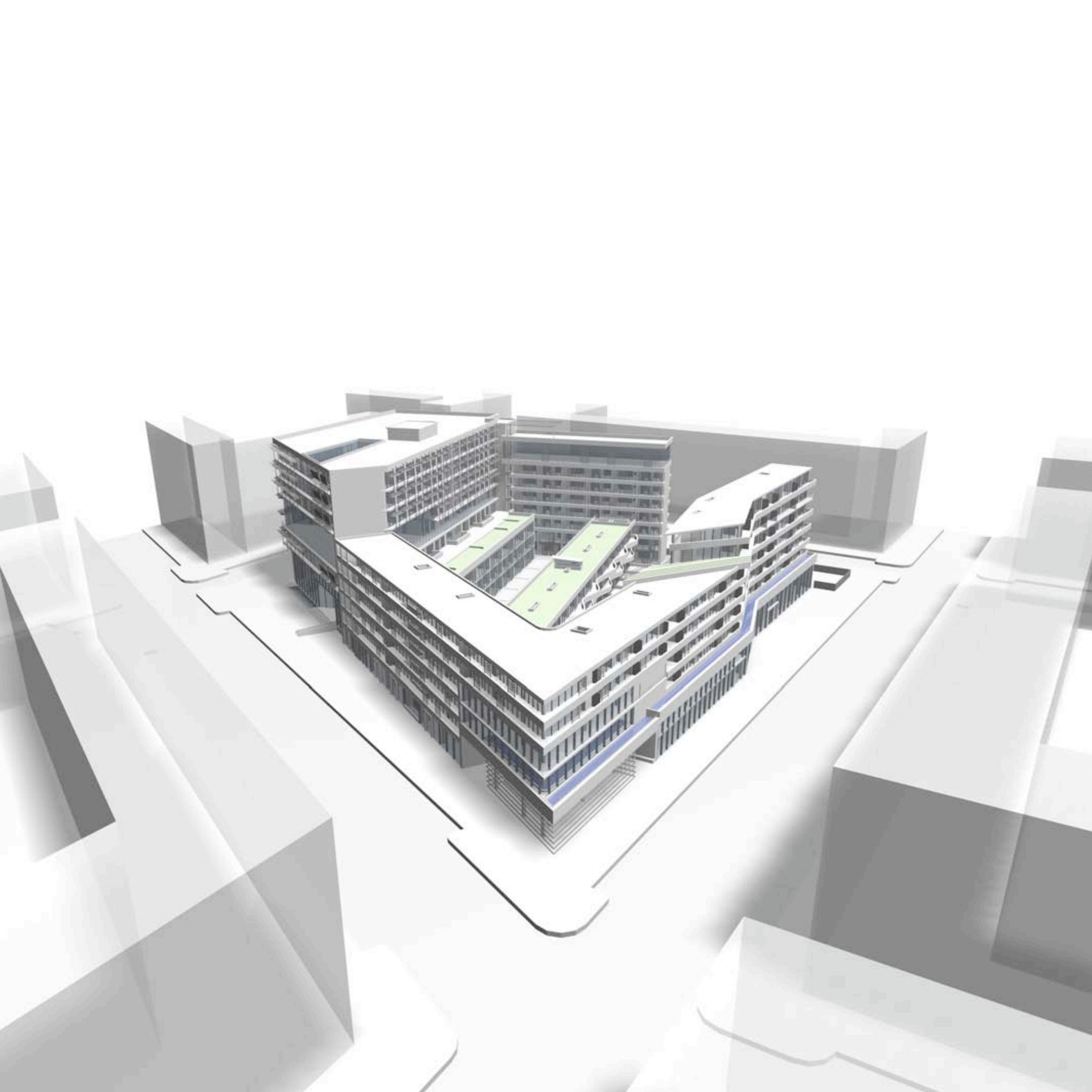
Die Energiekennzahlen dieses Energieausweises dienen ausschließlich der Information. Aufgrund der idealisierten Eingangsparameter können bei tatsächlicher Nutzung erhebliche Abweichungen auftreten. Insbesondere Nutzungseinheiten unterschiedlicher Lage können aus Gründen der Geometrie und der Lage hinsichtlich ihrer Energiekennzahlen von den hier angegebenen abweichen.

Figure 38 - Energy certification

68

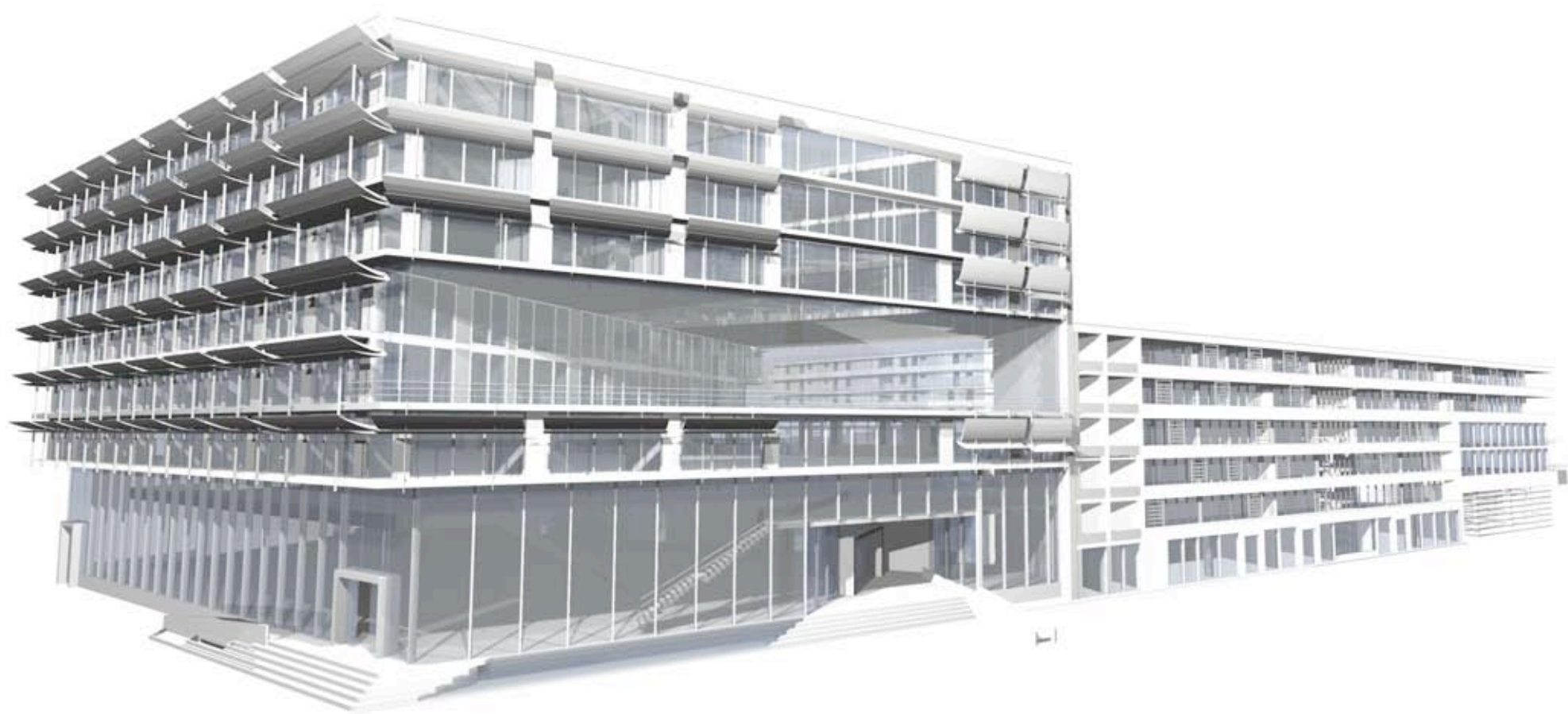
Visualizations

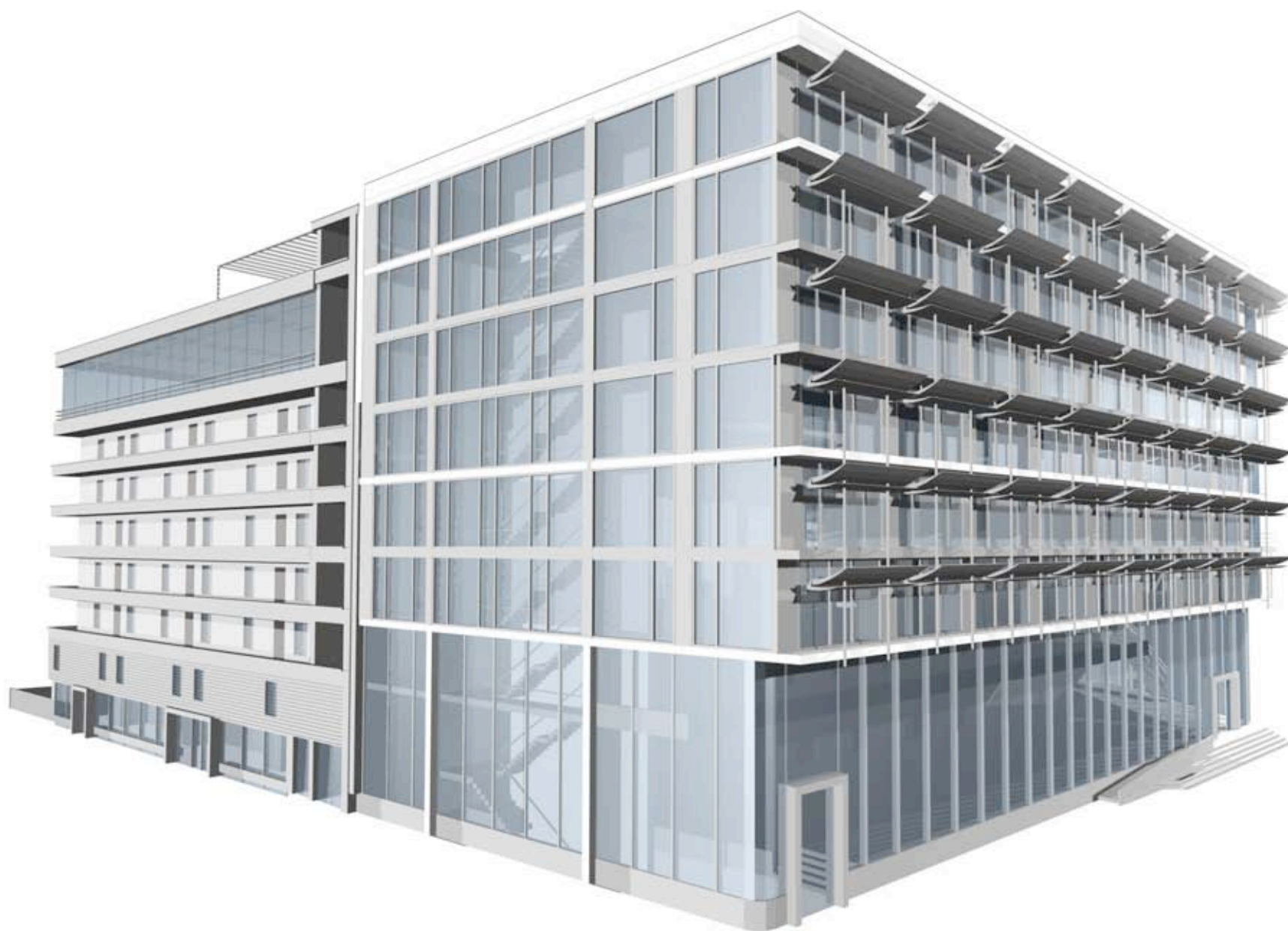












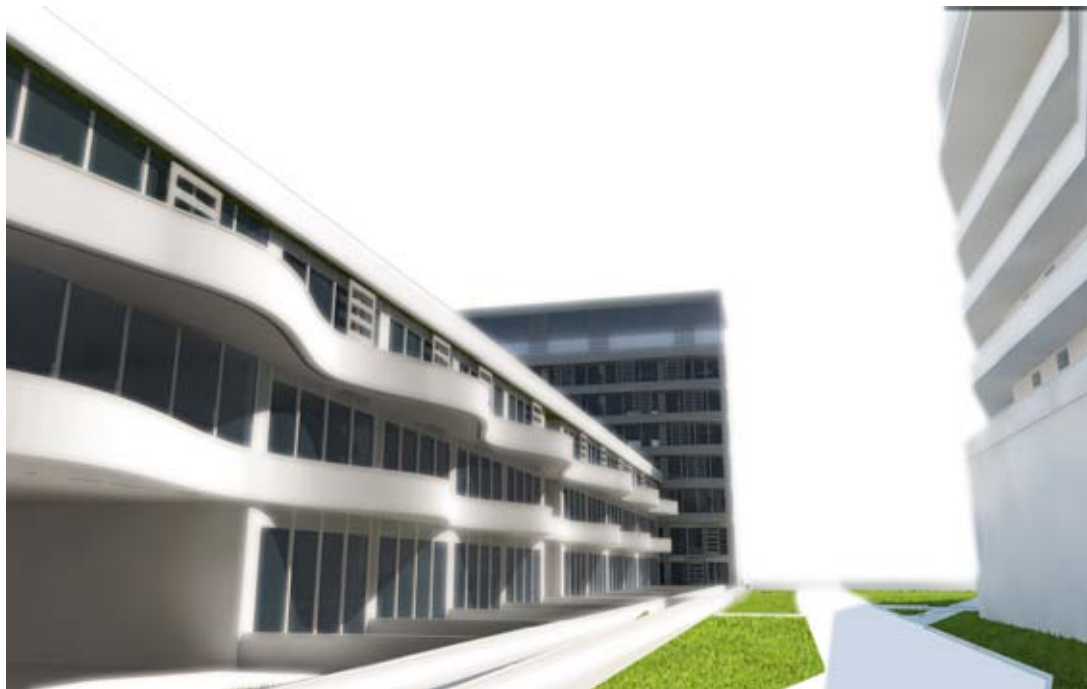


Figure 39 - Inner yard, east to west view



Figure 40 - Inner yard, west to east view

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