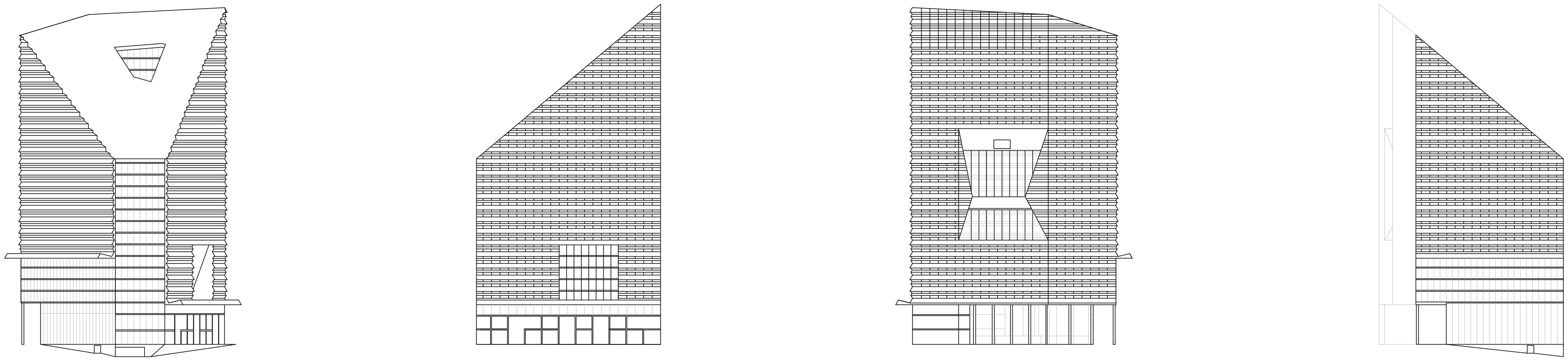

O S L O S O L A R

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Introduction -
Basic concept & Environmental strategy

Urbanism -
Analysis of Urban context
- site plan and sections

Eco efficiency -
Environmental principles of the concept

Architecture -
Project proposal and drawings

INTRODUCTION

Environmental goal
Our goal is to design a plus energy building that can be realised in short time, showing that C2C-thinking and use of environmental friendly technology is something that can be made common. To do so, the building needs to have a public appeal, be economically feasible, not involve too much risk, and use technology that is at hand. We want to be a strong part in developing an environmental friendly building industry by showing real results.
We also want to promote environmental friendly urbanism with high density and high quality of life as the most efficient way to reduce the carbon footprint in everyday life of common people.

Team
The core team consists of architects, researchers and engineers. The members of the team have experience from various projects where sustainability is central. Multidisciplinary teamwork and integrated design processes are part of our everyday professional life. The team members are in organisations with capacity and knowledge to follow the whole OSLOSOLAR building process and see the ambitions being tested and realised with success.

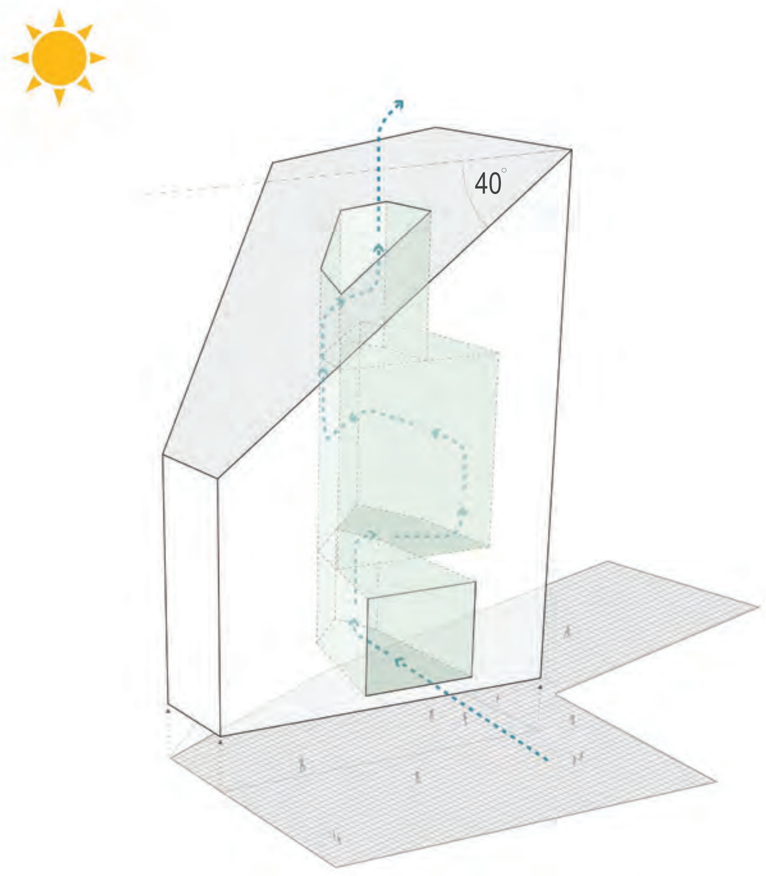
The starting point of our work on OSLOSOLAR has been a discussion between researchers and architects on technologies and concepts with the best potential for achieving the goals of the competition program. Working on the OSLOSOLAR concept, testing the ideas with specialists doing calculations and adjustments, we see the possibilities for optimalization and potentials for even better results.
The team has both the knowledge and the will to use the concept of C2C as far as possible. Although enthusiastic and inventive, we believe in pragmatism and recognize the challenge and complexity of Urban+.

Architectural concept
OSLOSOLAR folds out the largest possible surface within the site to harvest energy form the sun. The roof is tilted 40 degrees, facing south and placed above the shadow of the highrise buildings south of the site. The southwest and southeast facades have solar panels angled to harvest morning and afternoon sun, and at the same time offer shading for interior spaces.

Facing north, there is an atrium, an urban “grotto”, that runs through the whole building. The atrium works as a green lung that provides the offices with conditioned and fresh air. The atrium lets daylight into offices and makes it possible to see the city and to get a feel of time and weather from all parts of the offices. The green lung also gets light from a hole in the angled roof which runs down, mostly facing the city on the north side, but in the lower part of the building turns towards the park to keep an eye on the public life.

The building changes the city floor from dominated by cars to a shared space with universal designed traffical solutions that promote alertness, safety and movement by foot and bike. The foot of the building is an airy, urban lobby with integrated bike facilities, art space, prominent office entrance and various small retail programs organised to feed the park with atmosphere and activity.

Environmental strategy
For on-site renewable energy to cover the energy demand of the projected building, the efficiencies of the chosen technologies are of key importance. An efficient building envelope combined with demand controlled and optimized technical systems provides for a low net energy demand. The system solution for heating and cooling is a combination of district heating and on site energy production from thermal solar panels and PV-panels, air-water heatpumps/water chillers.
The calculations shows that the solar system with about 4000 PV-panels and solar collectors will be able to produce all of the heat and power needed for very efficient operations of the building, and with the required surplus.
The strategy involves ventilation systems with extreme low system losses, heating and cooling systems combining district heating with energy production from thermal solar panels, air-water heat –pumps/water chillers. Good daylight conditions is playing a n important part in both reduction of energy demand and health.
The material calculator is used as a dynamic tool in constructing the building. The materialisation of the building focuses on re-use and solutions for minimizing amounts.
Part of the strategy is to use the knowledge about the substantial environmental effects of central nodal point developments. The architecture should articulate this and use design strategies, research and expertise to ensure the best possible design for the ground floor areas, ensuring a universally designed green mobility and an urban atmosphere with desired activity and high quality.



URBANISM

CONTEXT ANALYSIS

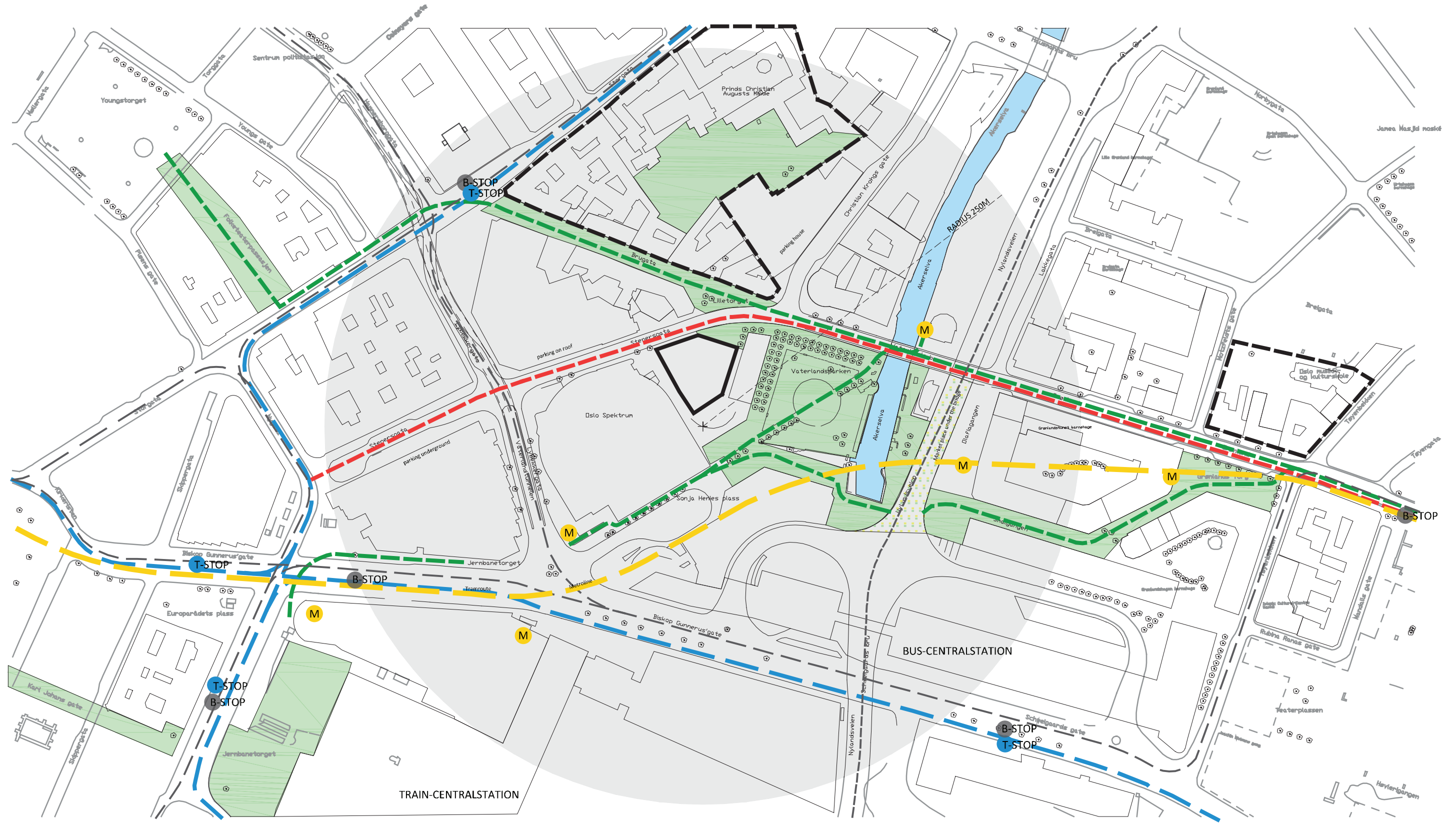
Lilletorget 1 lies at the gate of gravity of Oslo city centre, in the transition between the buzz of the borough Grønland and the busy down town. The built structure shifts from blocks with inner courtyards with commercial retail etc. on ground floor and residences above, to single programmatic closed blocks. The height of the buildings shifts from 4-8 storeys high in Grønland to 37 storeys (SAS Radisson).
Two road systems are visible from the site, the local street Grønlandsleiret passing on the north side that brings people in and out of the city core in east-west direction, and the elevated bridge that is visible, but not accessable from here, that transports north-south.

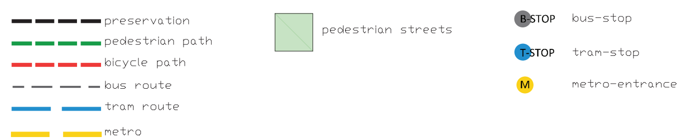
Apart from the neighbouring buildings, the site is formed by the turning of Grønlandsleiret to Stenersgata to the north and west, and the Vaterland Park to the east. The site is flat, with the Park in front sloping to the east and the river Akerselva in front. This is the last spot where the river is open before it flows in a culvert under Barcode and out in the fjord behind the opera house. It connects one to Marka, the city's green hills and forests surrounding the city to the north. The trail along the river stops 500 meters north of the site.

There is still and has been the recent years a lot of building activity in the old parts of Oslo, including the Bjørvika area. The population of the district of Gamlebyen, (which Grønland is a part of) is expected to increase in the next ten years primarily because of migration of people of working age; 25 000 new residents by 2023 will make Gamlebyen the most populated district in Oslo, according to the City of Oslo.

The site being part of the "pot", it is surrounded by public transport. Bus and train station being 150-300 meters away, and all the metro lines connecting you to the rest of the city. The bike route coming from east through Grønland, abruptly stops in the square of Lilletorget. The site is connected to the main footpaths; the park being part of various shortcuts to and from Grønland. The Vaterland Park being a needed open space in the pot, it sadly functions today mainly as a place to pass through during the day, and because of its sheltered state, it has become a place of vagrants and feelings of unsafety at night. The park has all the potential and the people which "inhabit" the park today, is not really the problem. The lack of program on the ground floor of the buildings surrounding the park creates dead facades and little bustle. Along the local street it is retail, offices and coffee shops that constitutes most of ground floor activity in the vicinity, while bars and some restaurants make out the after-hours activity.

GROUND FLOOR - CONNECTIONS





URBAN ANALYSIS
m=1:500 (A3)

URBANISM

CONTEXT ANALYSIS - **response**

As a programmatic response to the urban context, we propose a building with an urban lobby, a vertical, green "grotto" and public activities on the top floor.

The urban lobby opens up to the shared space of Lilletorget and stretches over three floors. It serves as a bicycle hub with workshops, coffee, and restaurants etc. both for the visitor and the employees.

The urban "grotto" exposes you to nature both from the inside and outside and leads the public in vertically through the building - for sports, dance and other activities on the top floor. The grotto with its green atriums that are visible in the facades, makes the building relate to the surroundings, and towards the park, it keeps an eye on the public life.

Putting program and activity on the ground floor in the new building is an evident solution to bring life to the park, but this should also be followed up by the surroundings. We propose that Lilletorget is formed as a shared space and regains its position as an actual place, and not leftover space, where pedestrians are prioritized. The urban lobby invites from here, the building changes the city floor from dominated by cars to a shared space with universal designed traffical solutions that promote alertness, safety and movement by foot and bike.

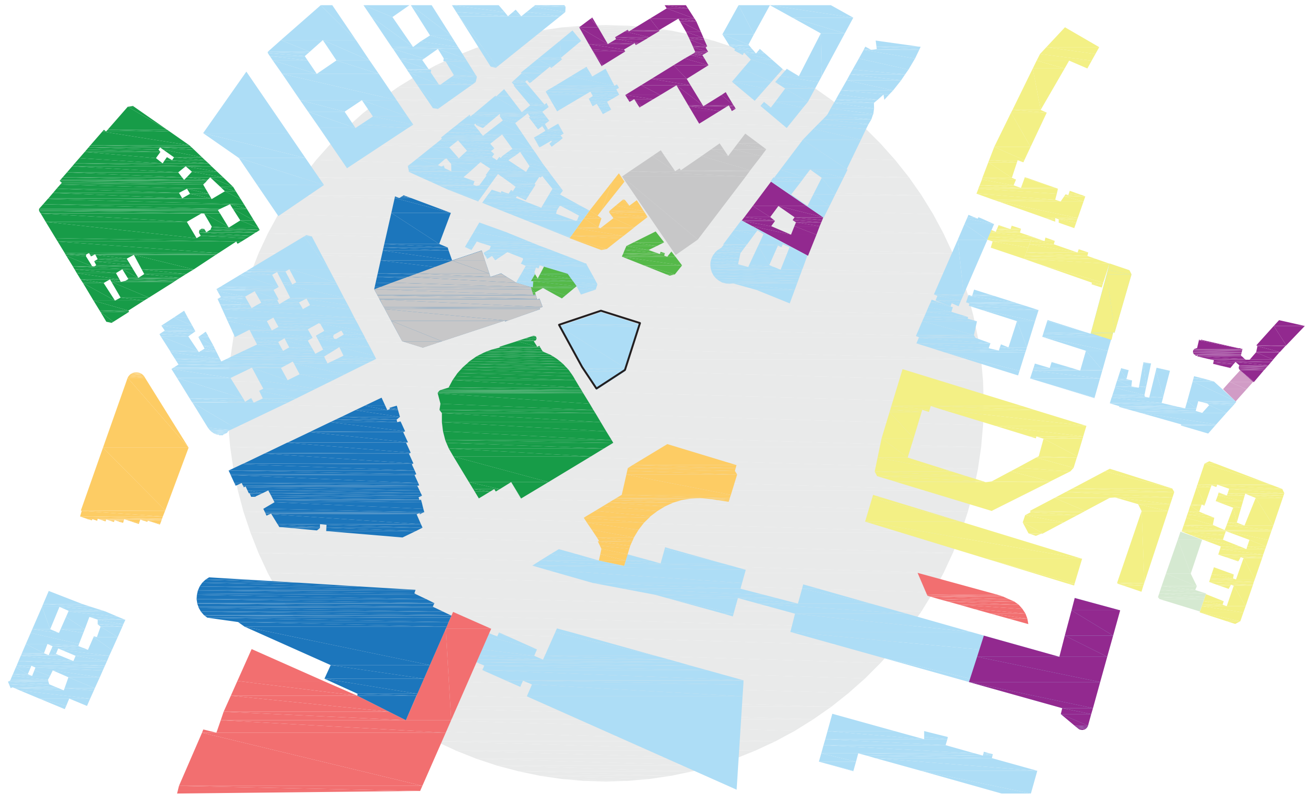
Apart from the direct health benefits the park has as a green lung in the city cleaning air, it also gives the people living in the area an opportunity to get in direct contact with nature. Upgrading and opening the park up to a plural, modern urban square, could make citizen ownership and easier let activity spill out from the buildings. The symbiosis between the park and the building will make the whole greater than the parts. The park becomes a corridor for possible bird life to the caves of the building. A restaurant in the building wanting to focus on local food and permaculture, can grow and harvest from right here.

The SAS Radisson hotel wing that is partly responsible for the dead facades along the park, should with the planned extension propose a public program on the ground floor that allows people and light to spill out from that side as well.

The market place under the road bridge on the other side of the river, the foot path leading past the park, and the park itself should be connected with a lighting concept. This is the smallest intervention, but could make the area around the river as a whole be a place for big outdoor concerts, market place during the weekends, etc. Patching up the last 500 meters of the river walk that is lacking, will also connect the site and the park directly to Marka.

MAIN PROGRAM ON GROUND FLOOR

MAIN PROGRAM ABOVE GROUND FLOOR



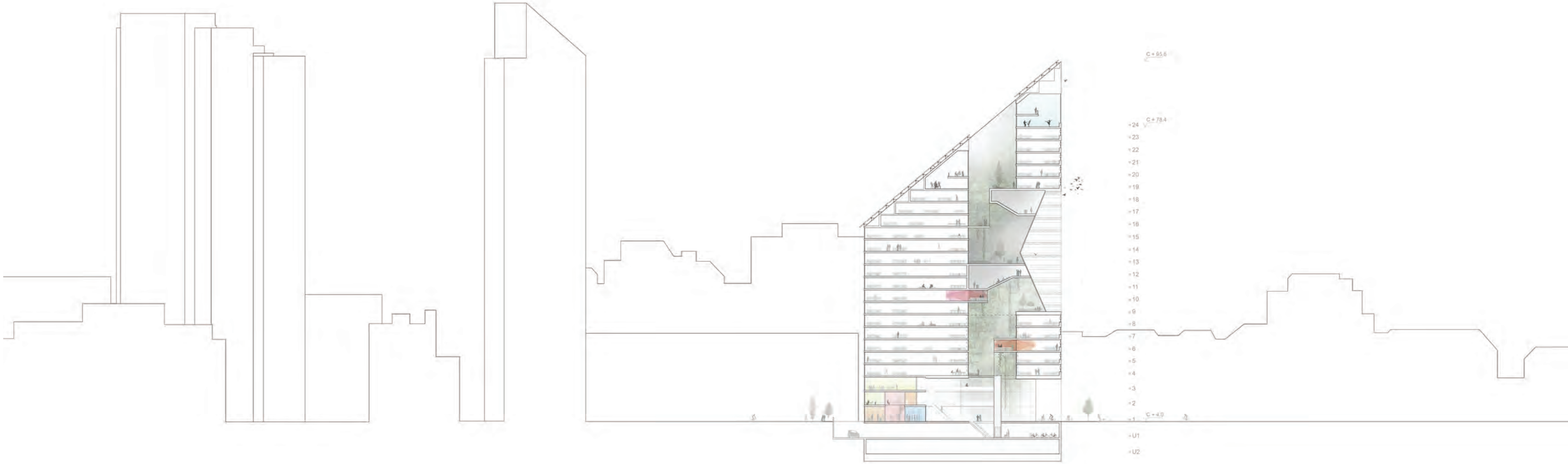
URBAN ANALYSIS
m=1:500 (A3)

URBANISM

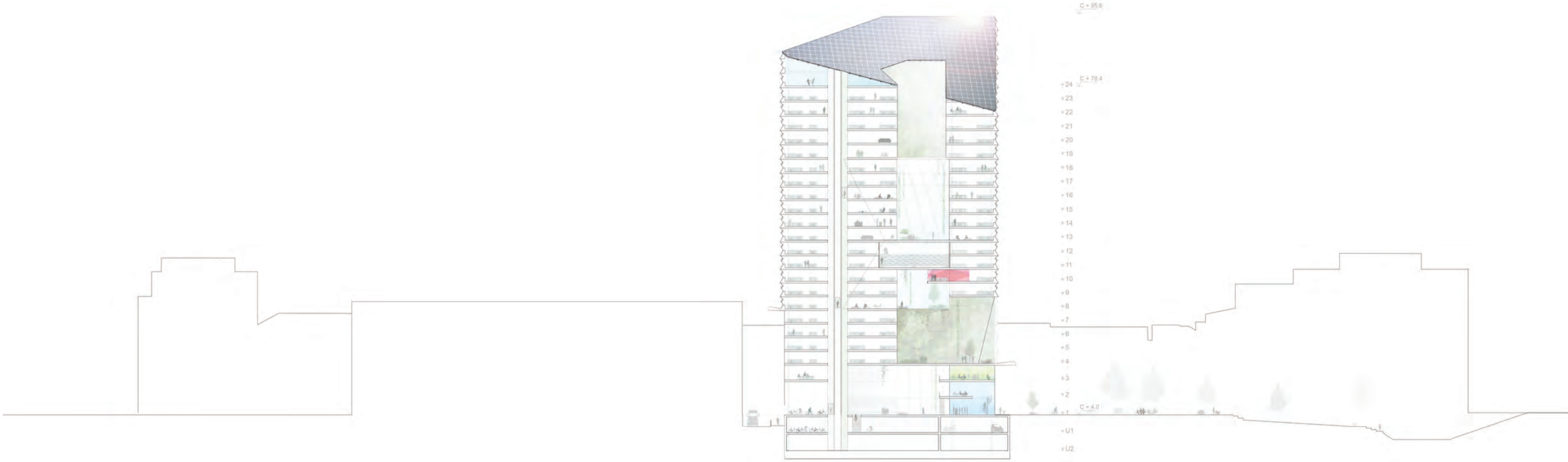
situation plan 1:600 (A3)

URBANISM

situation sections 1:1000 (A3)



North-South section



East-West section

URBANISM
illustration Vaterland Park refreshed

ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **energy calculation**

The energy balance calculations are based on NS 3031 and conducted in Simien ver. 5.500 according to the requirements in NS 3701.The calculated energy production from solar cells are done for several different solutions, and there average value is used in the overall energy balance scheme. For further information look at the documented calculations for PV-system.

For on-site renewable energy to cover the energy demand of the projected building, the efficiencies of the chosen technologies are of key importance. The calculations shows that the solar system with about 4000 PV-panels and solar collectors will be able to produce all of the heat and power needed for very efficient operations of the building, and with the required surplus.

Initial cradle-to-cradle calculations shows that the energy and environmental pay-back for the panels can be between 1-4 years depending on where the solar panels have been produced and the carbon intensity of the silicon and module production value chain.

All numbers i kWh/year		**Delivered energy**		**Weighted delivered energy**	
Table 5 NS3031	Net energy demand	District heating/cooling	Electricity from grid	District heating / Cooling	Electricity from grid
1a and 1b Heating	255 961	301 131		129 486	
2 DHW	150 349	151 868		65 303	
3-4 El-specific	318 893		318 893		318 893
6. Cooling	161 014		59 635		59 635
Grand Total	886 217	771 891		513 682	
Grand Total per m2	29,5	25,7		**17,1**	

Local Production (All numbers i kWh/year)	**Solar Cell**	**Solar heating**	**Other renewable electricity**	**Other renewable heating /cooling**	**Total**
Roof	200 000				200 000
Facade	370 000	90 000			460 000
Techical room					
Other					
Total	570 000	90 000			660 000
Total per m2	19,0	3,0			**22,0**
Energy balance	**22,0 - 17,1 = 3,9** > 2,0 kWh/m2 year				

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **energy and water supply**

ENERGY SUPPLY

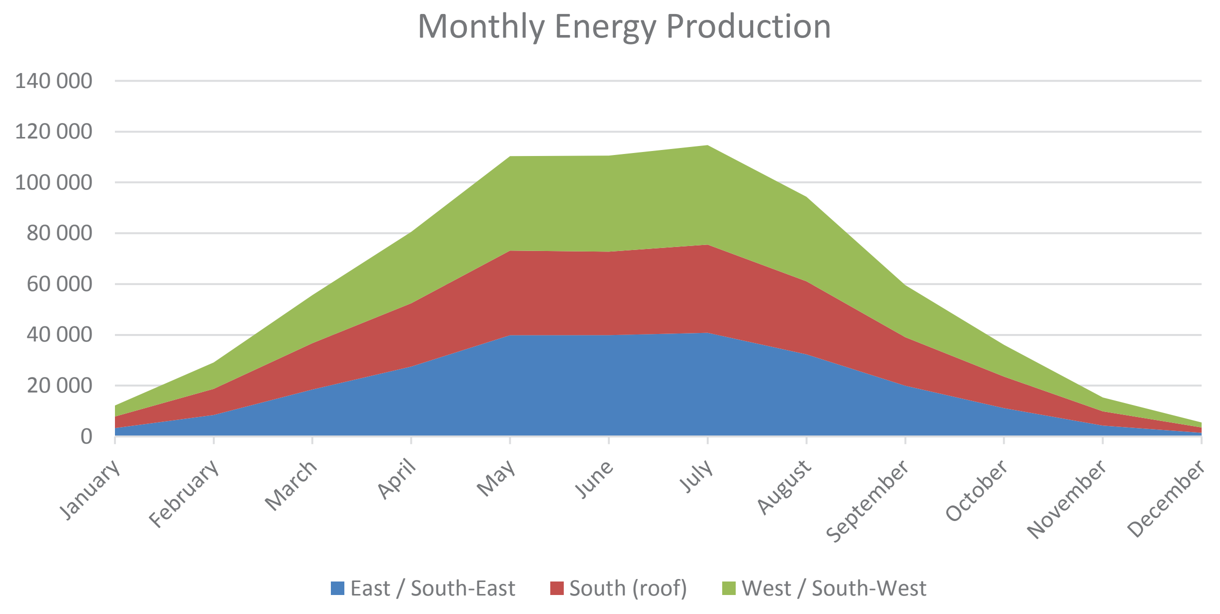
The system solution for heating and cooling is a combination of district heating/cooling and on sight energy production from thermal solar panels, air-water heat-pumps /water chillers.

The heat and power is produced from integrated solar panels and collectors. In addition, there is done energy evaluations of wind power chimneys and the use of rain water for power production. This is explained further in the appendix.

The ratio between solar panels and solar collectors should be investigated in more detail depending on if it is possible to sell the excess heat to nearby users or the district energy system. A solar collector can have a heat production of 300-700 kWh/m2 panel, while a solar cell panel usually do not produce more than 130 kWh/m2 per year of electricity in Norway.

WATER SUPPLY

Use of rainwater collected (rainwater harvesting) at different levels at the roof, that with appropriate filters can be used for toilet flushing and irrigation. Sustainable drainage will further be a combination of retention, shallow wetlands and surface/sub surface filtration.



The figure shows the monthly electricity production for each of the facades from the solar PV-panels.

ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **ventilation / heating and cooling**

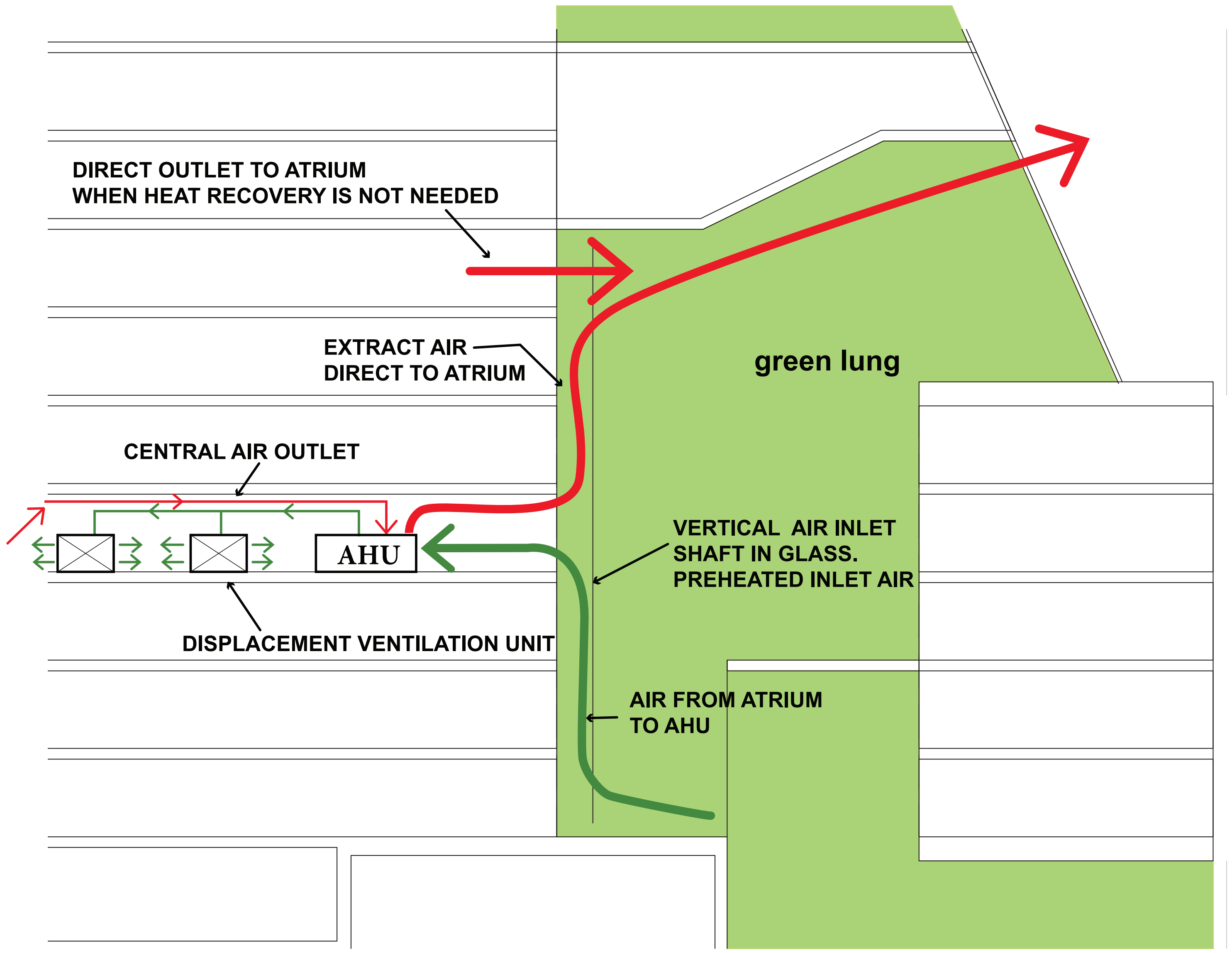
The system solution for heating and cooling is a combination of district heating and on sight energy production from thermal solar panels, air-water heat-pumps/water chillers. To reduce the demand for heating and cooling there is important to have a robust and flexible overall approach towards temperature levels and allow the building to operate according to the external heat gains and influence from sun, wind and temperatures.

The ventilation strategy for the building is based on the following main principles:
• Displacement ventilation with a high ventilation efficiency
• Air is distributed using inlet units integrated to the inner walls
• Decentralised Air Handling Units, with demand controlled automation.
• Hybrid ventilation with the use of atriums; where air intake is placed at the northbound façade and filtered with the use of plants and green walls in the atrium
• In the period of the year when heat recovery is not necessary the extract fans is stopped and air floods via the atrium
• Low SFP-factor, short distance between AHU and air distribution
• central air extract solutions, with a minimum of ducts and system losses

This gives us a ventilation principle with extreme low system losses and a good indoor climate

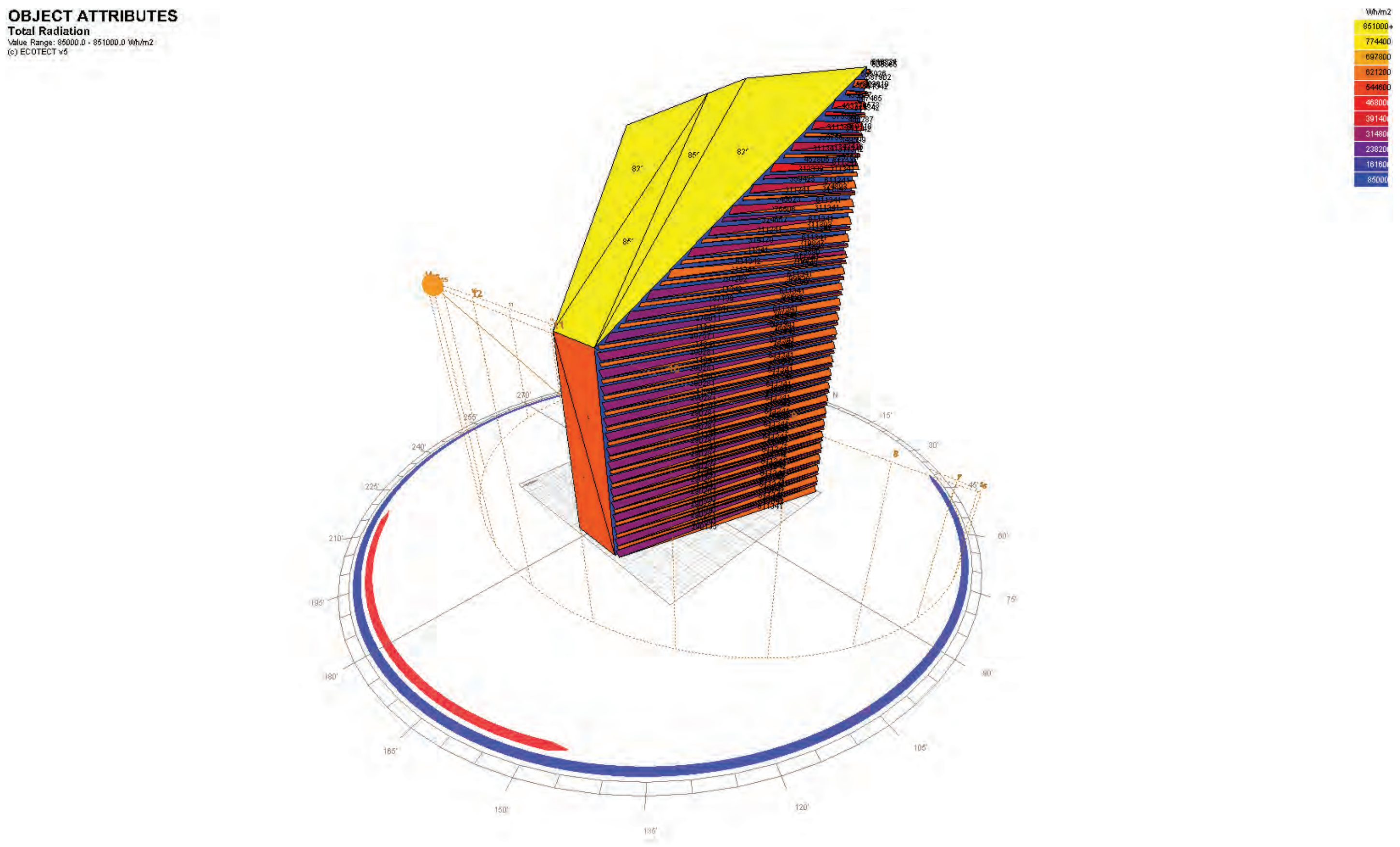
The heating strategy is based on the following main principles:
• Highly insulated building envelope which gives a low heating demand
• Low temperature heating systems, use of either few and big convectors placed in open area situations or thermo active building element, with low system temperatures
• District heating in combination with solar heating panels
• The tilted windows panels will provide passive solar heating in the periods with low solar angel

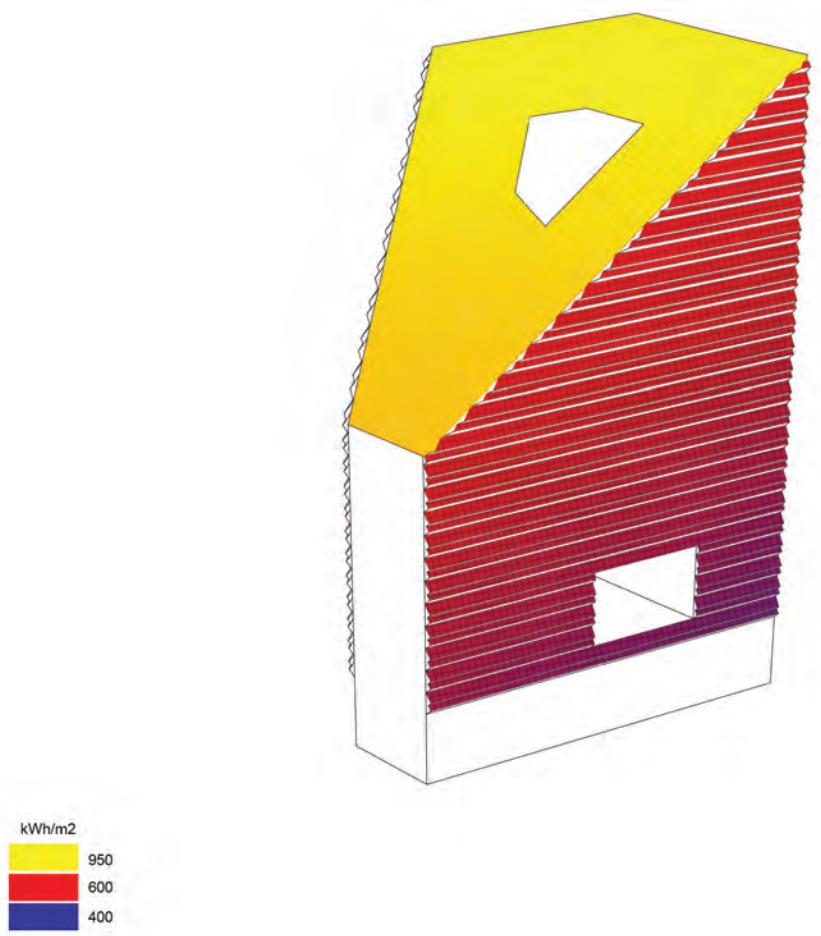
The cooling strategy is based on the following main principles:
• Effective solar shading and extreme low internal gains
• Use of high specific heat capacity absorbing elements in the structure, which in direct contact with the cool air inlet units
• Free cooling using the AHU system at nighttime
• Free cooling towards the atrium; where we use the cooling effect from water evaporating

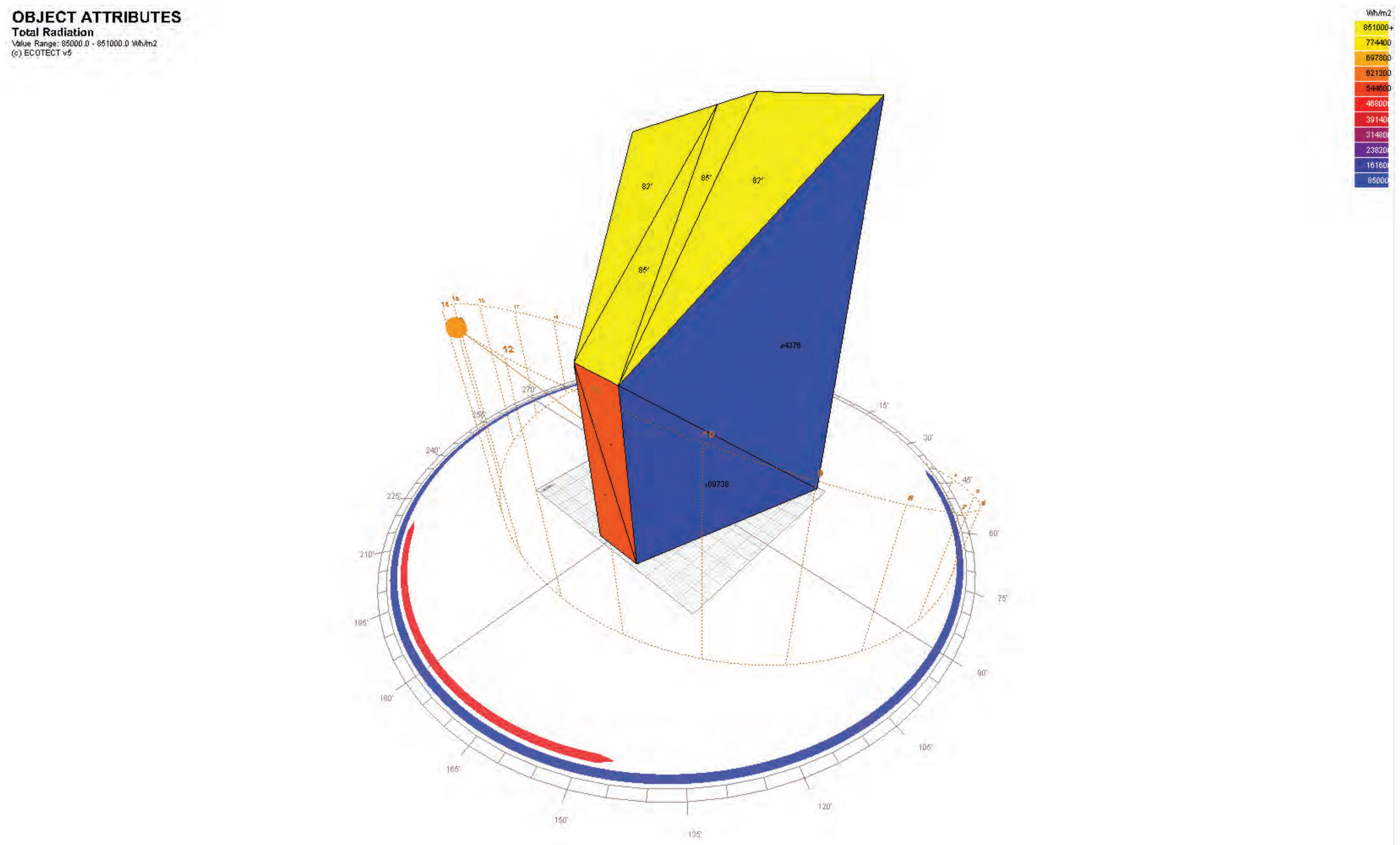


ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **solar studies**







ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **facade**

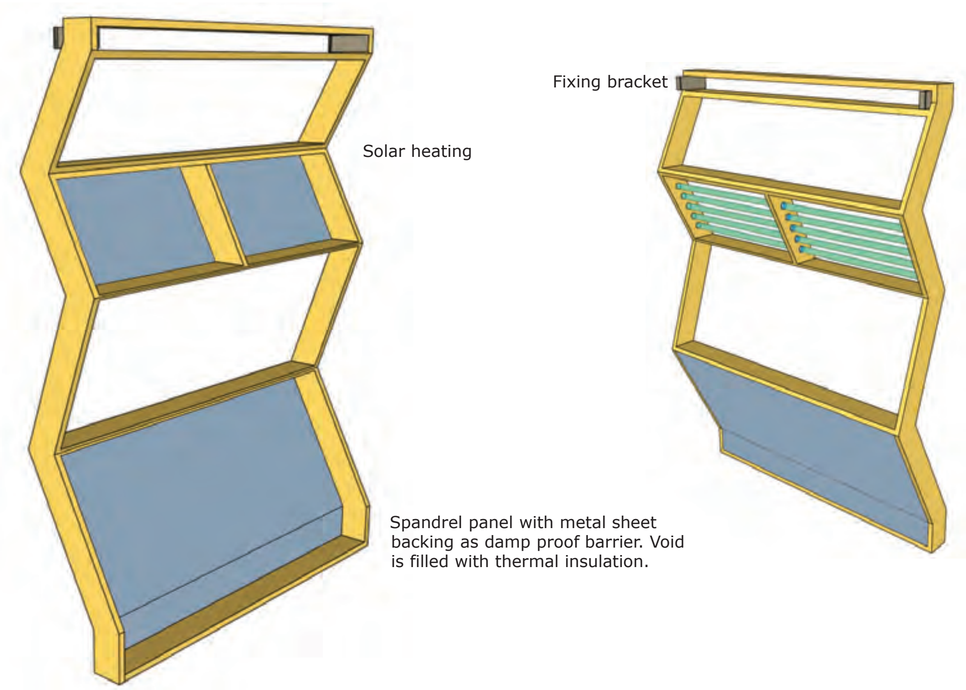
The facades are constructed from unitized facade panels in order to achieve a speedy erection and high quality of the finished product. This will reduce on-site working time with 80 % compared with traditional site mounted stick facades.

Timber is proposed as the facade panels' structural materiale because it presents:

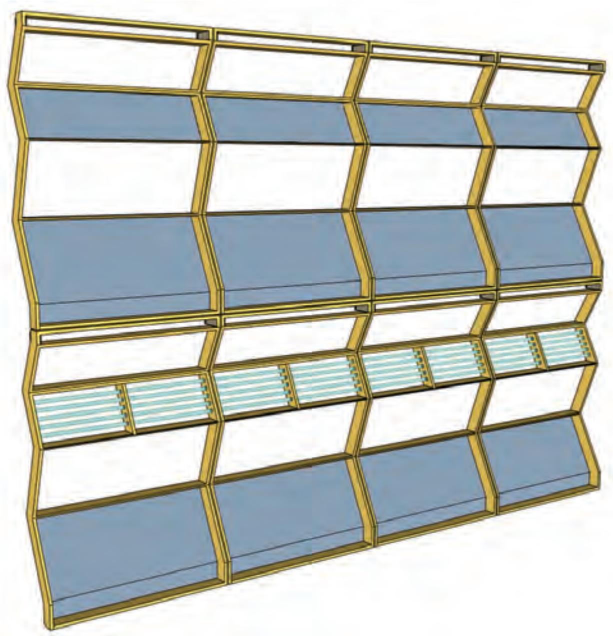
• A potential for an innovative development of the Norwegian facade cladding industry
• Superior thermal properties compared to traditional aluminium based facade systems
• Considerable reduction in the facades' carbon footprint

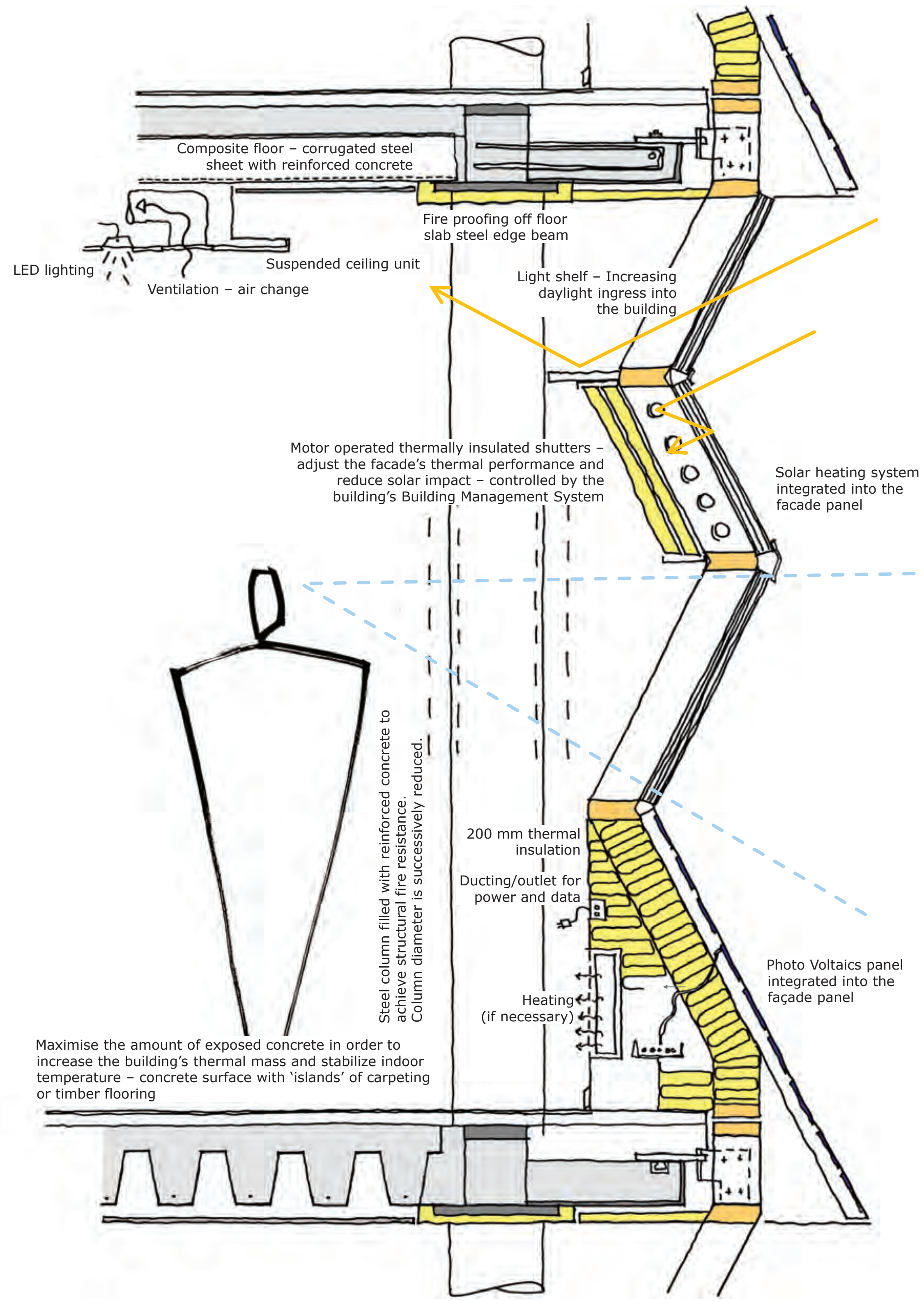
Furthermore, laminated timber technology lends itself seamlessly to the zig-zag shape of the facades' vertical profiles.

All exposed external parts of the facade panels (cover plates and fixing system for the triple-glazed insulating units / photo voltaic panels) will be produced in anodized aluminium in order to achieve a cost efficient and low maintenance facade system.



Prefabricated unitized timber facade panel





ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **daylight and solar shading**

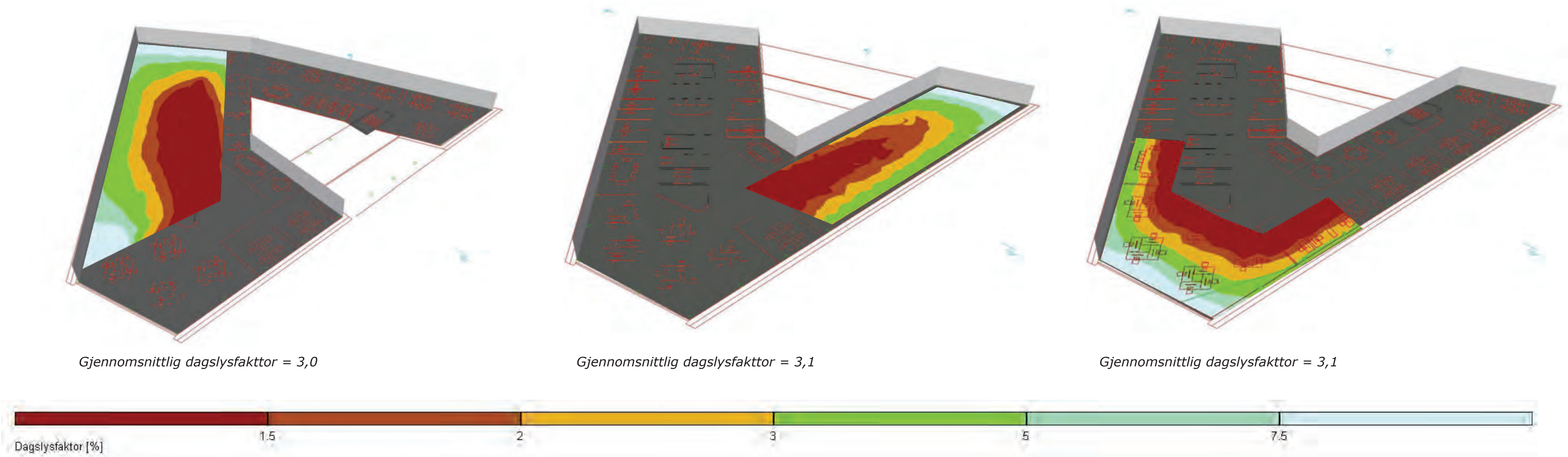
A rich distribution of daylight has been a leading premise in the design of the overall geometry of the building, the floor plans and the façade. The tilting of the façade elements means that the façade itself functions as a natural solar shading system. This ensures good daylight conditions even when the sun is up. In the upper part of the façade, only transparent glass or translucent solar collectors are used. This contributes to good daylight distribution in all office areas. The overall geometry of the atriums has also been designed to ensure a good distribution of daylight into the building. The façade between the atrium and outside has been placed partly into the geometry of the atrium, to allow maximum of daylight to enter through the north facade. Furthermore, the atriums are kept as high and open as possible, to ensure that they allow as much daylight as possible to enter further into the building.
The building lives up to the criterion in Hea 1 in the BREEAM-NOR manual, with a good margin. The average daylight factor is above 3 in all the office areas.

The façade is divided in four different segments, where there is a reflective light shelf in the upper part providing natural light to the office area. The light shelf allows daylight to be distributed further into the office areas.
The thermal solar collector is partly translucent and will also provide a significant contribution. Behind the solar collector there is sliding panels that will apply as solar shading.
Below there is a window panels that provides for view from the office area/desk.

The overall lighting strategy is a daylight system with optimal use of natural light. High efficiency LED/OLED light fixtures in combination with active use of reflectors to distribute light to the inner zones of the building. With a well-designed daylight sensor system controlling the artificial lighting, the amount of energy used on lighting can be kept on a minimum. There could also be developed solutions using fiber optics for harvesting daylight and distribute to areas with less possibility for direct daylight utilization.

SOLAR SHADING
All windows are tilted/angeled so that the direct sunlight is reduced. The windows are energy-efficient and with a low solar factor which reduces the heat gain. Behind the solar collector there is sliding panels that will apply as solar shading.

To achive both sufficient passiv solar gain and avoid glare from computer screens there is an internal shading (curtain).



TRANSPORT

Alternative transportation (Tra 3 BREEAM-NOR)
The building has 100 bike parking on street level in close connection to the lobby. The bike parking is integrated in the building and a part of the articulation of the entrance. In addition there are 200 lots in the basement. In relation to the bike parking there are facilities for showering and drying clothes as well as washing/fixing bikes.

Safety for pedestrians and cyclers (Tra 4 BREEAM-NOR)
The bike parking is integrated in the architecture of the lobby area. It is well lit and the entrance is well defined. The ramp to the basement parking is a 2-lane bikeway. The bikeway does not cross any other traffic, and is well lit and coloured red. In our proposal Lilletorget becomes a continuous square crossing Stenersgata. The car lanes at cut off by pedestrian paving. Only bike lanes continue as clearly marked lines cross the Lilletorget square. The proposed design of Lilletorget, with the crossing of Stenersgata, uses the knowledge of “shared space” as a mean to increase alertness and safety. Lighting plays an important part in defining this “shared space”.

Maximum car parking (Tra 6 BREEAM-NOR)
There is HC-parking in the basement, in total 15 places. Each lot for HC-parking can be used for two el-cars. There is no parking for conventional cars. There is a potential for el-car-pooling powered by the electricity produced by the photovoltaic panels on the roof.

CRADLE TO CRADLE STRATEGY - HOLISTIC APPROACH
Balancing ecological, social and economic factors are key to a successful Cradle to Cradle® building, and to better life quality for all, including the planet.

ECONOMY
The refurbished building offers high, “new and different” qualities, experiences and service that will attract people and help educate clients on the value of a work place with fresh, clean air and thermal comfort, a chemical free environment that reduces absence and make employees more happy and productive. The architectural design gives higher rental prizes and attracts new clients and increased space and high area efficiency optimizes the cost of the project.

SOCIAL
The concept is based on giving parts of the now easy accessible building back to the public, by opening a central atrium staircase with panoramic views, public top floor with various activities, ground floor with shops and restaurants, and a public space in front of the building. The atrium enables increased daylight, and will invite to take an architectural tour by stairs to the top, thereby generating health, joy and enough energy to run e.g. the coffee machines during day.

ECOLOGY
Sun, water and vegetation are used in natural cycles that create a place with a high wellbeing factor, both indoors and outdoors. Clean and safe materials and products add to a healthy indoor climate. Outdoor vegetation will increase biodiversity with local species, and the restaurants can serve local and exotic fruits and vegetables from the roof garden.

CONCEPT REUSE
A great part of the façade cladding will be used in the interiors. Other parts may also find new life in the reinvigorated building, but we will also suggest another possible solution; C2C is about real recycling, or upcycling – where the materials gain better qualities, instead of eventually becoming waste. By investing a relatively small amount of money, Entra could host an international architectural competition - to reuse the exact material from the original building, in a context where a façade is more climatically suitable.

Building elements/materials:
FAÇADE
Perforated aluminum plates with a high percentage of recycled materials can be reused, recycled og repurposed after ended lifetime. Aluminum is a light material with the benefit of not losing its technical properties after being recycled. It’s many options in perforation pattern and percentage means it can be flexible in its purpose. For example; doubling as sun shade.

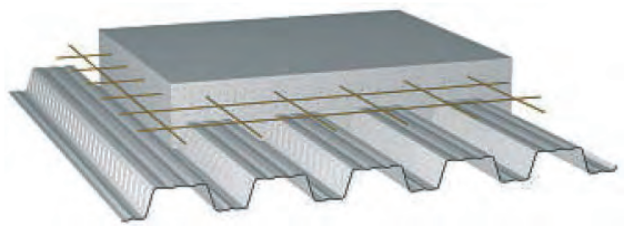
PARTITION WALLS
Partition walls should be flexible and able to serve multiple functions as well as consist of C2C-materials. This can be solved by using lock-in-place walls, shelving units or mobile pods. Materials can be based on recycled woods as they are considered furniture and not internal walls in regards to fireregulation. The walls can even serve as “green lungs” in the office space if covered with plants.

ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **carbon emissions from materials**

FLOOR THICKNESS AND WEIGHT REDUCTION

Using composite floor (ComFlor60 or Cofraplus60) with short span widths, only 3.6m, give a significant concrete reduction. This design gives a total flooring thickness reduction of between 25 and 40 centimetres according to the structure.
Depending on the limitations of the project, this means that the room can be higher, extra floors can be added or the total height of the building can be reduced. This degree of flexibility as regards to height, allows great freedom in the design of the façade and the roofing and savings can be made.



BUILDING ELEMENTS / MATERIALS

Steel elements, 100% recycled, used throughout the building frame provide a light structure. Bolted connections allows the steel to be dissembled, and reused in the same form on a different structure. The steel sheet, part of composite floor, can be separated from the concrete and recycled after melting.

In order to reduce the carbon footprint, low carbon concrete should be used. This concrete can later be reused on another project as aggregate in that concrete. Rebar mesh near top surface of concrete should prove relatively easy to separate and reuse in its original form or melted.

Materials mentioned above, are have long service life and requires little maintenance and meet the requirements for clean and recycled materials.

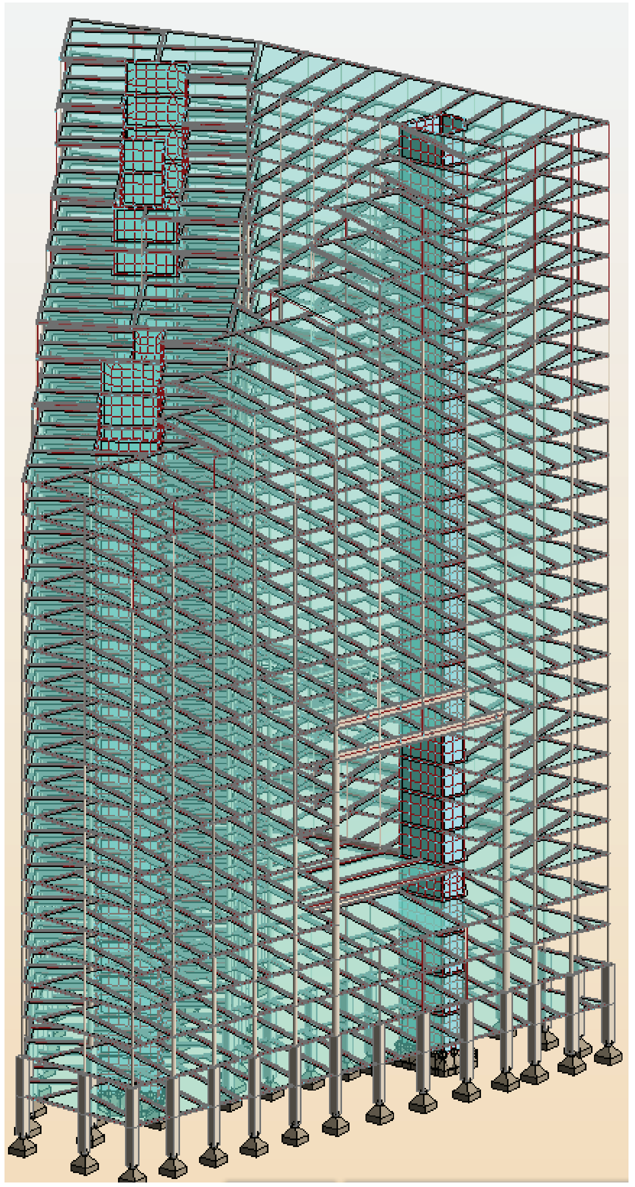
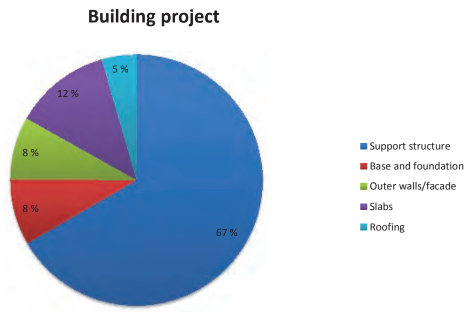
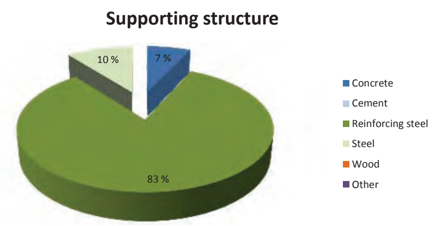


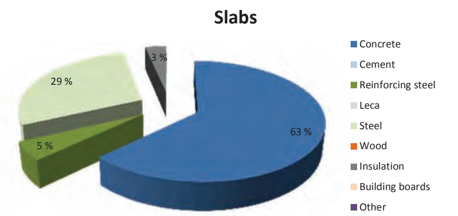
figure: building frame

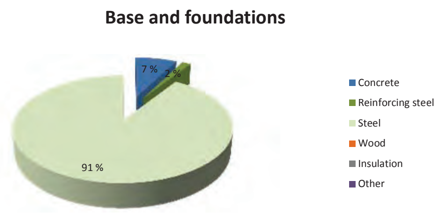
Impact distribution

Support structure	7873 tonne CO2 eq
Base and foundations	999 tonne CO2 eq
Outer walls/facade	957 tonne CO2 eq
Slabs	1461 tonne CO2 eq
Roofing	529 tonne CO2 eq



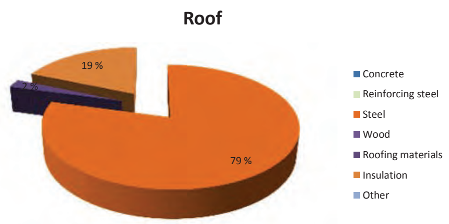


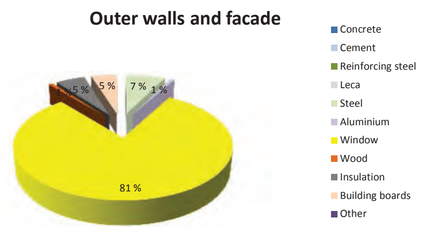




Outer

Concrete
Cement
Reinforcing
Leca
Steel
Aluminium





ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **biodiversity on site and immediate surroundings**

Urban ecosystems are near where most people live, so they provide opportunities for direct experience of nature. Together with an energy-producing building this creates a valuable symbiosis and a symbolic eco-hub for a new type of inner-city life. Strengthening bio-diversity at the core of the city will be an attraction for living creatures of all sizes.

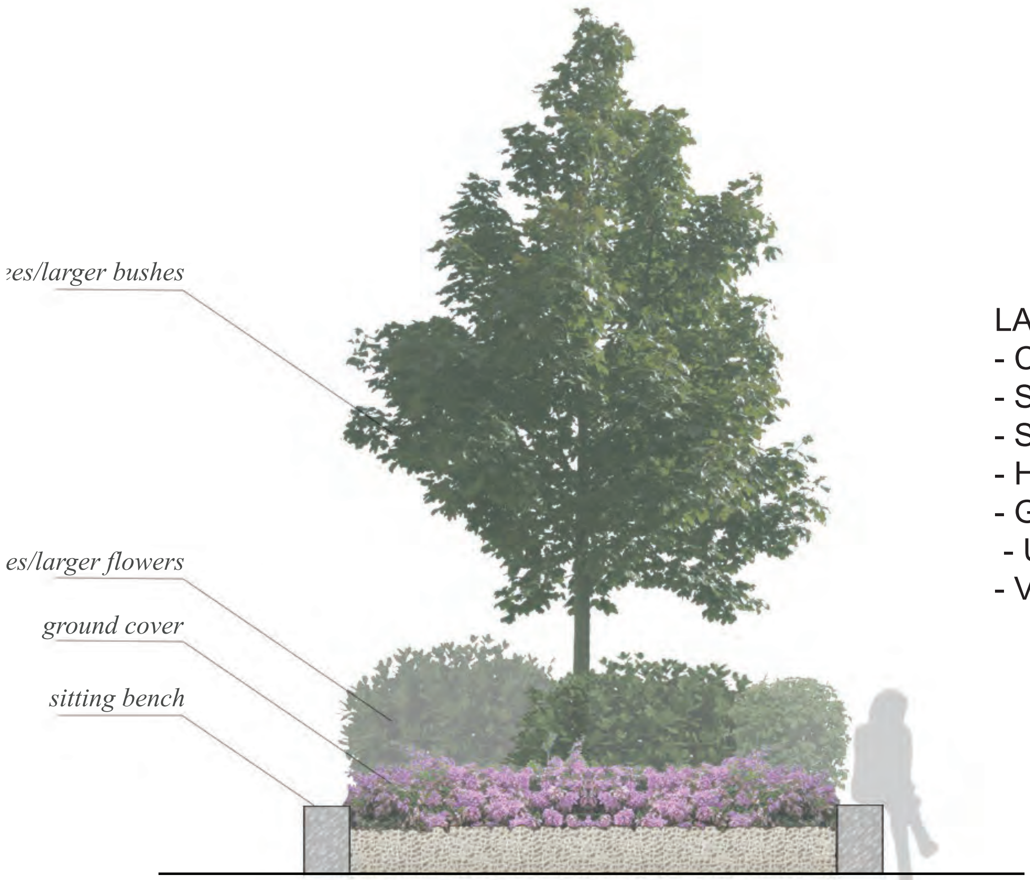
Truly urban ecosystems are unique. There are combinations of native and exotic species which would never exist outside a heavily humanised environment. Urban ecosystems as parks and gardens are completely artificial, but they can nevertheless provide great habitat for wild species, (especially animals).
Disturbance and stress are important factors in urban ecosystems. Constant disturbance is the norm, and the cycle of redevelopment is some 50-60 years, which is a very short time in ecological terms. A high level of stress puts a limit on the development of an ecosystem, as the number of species which can survive under stressed conditions is limited. Walls and roofs are extreme examples of stressed ecosystems, but very common in cities. Their rural counterpart are cliffs and scree, which are relatively uncommon. Pollution is a stress which is generally more severe in urban environments.

Objective: To make a truly urban ecosystem
- To use greenery both for health (indoor climate), economic/environmentally (reduce powered ventilation use, etc)
- To implement local flora in the continuation from Akerselva as to make it possible for local fauna to settle as well
- Possible production of edible plants for restaurants that can make use of it on site
-Birds, bats and bees are invited into the building – integrated panels in the façade as housing/nesting possibilities

Site and immediate surroundings:
Strategy: Design a landscape where the needs of humans and wild creatures are integrated and to make possible re-establishments of Akerselva biodiversity.

The main design consideration is to select a range of plants which will provide food (for birds and animals) at the times it is most needed, or over as long a season is possible.
The best plants for native wildlife tend to be native plants. These are the species best adapted to the local environment and also to the species that the local wildlife has adapted to. Plants native from the Akerselva-environment will be used as the primary source for establishing biodiversity.
Using the principles of stacking layers of different plants; shrubs, bushes, trees--- The diversity leads to a much better stability in the ecosystem, thereby greatly reducing the incidence of pests and diseases.

Planted surfaces bind dust and functions as retention basins, in order to delay the release of storm water that overloads many urban drainage systems. Trees and plants also break down carbon dioxide into oxygen and carbon that is stored in the soil and vegetation, and acts as a barrier against wind and weather which make them useful in urban areas. Several species of climbing plants have an ability to absorb and break down a range of well-known pollutants including benzene, formaldehyde, tetrachloroethylene and carbon monoxide.



Circular Concrete Planters

the planters are of three sizes/diameters:
S (5m), M (7,5m), and L(10M) and filled with layers of vegetation, and the sizes of plants are selected for each size.

LAYERS IN THE PLANTERS
- Canopy/tall tree layer
- Sub canopy/large shrub layer
- Shrub layer
- Herbaceous layer
- Groundcover/creeper layer
- Underground layer
- Vertical/climber layer

Akerselva
Akerselva and the nature along the river are characterized as a biologically important ore with regional value for bio-diversity. It represents an important living environment for birds and fishes, like, amongst other things, being an important wintering area for waterbirds, and for sea trout and salmon wandering upstream to spawn. It functions as a significant green corridor through the city which birds and plant species can spread along.

Varied and continuous vegetation should be developed/re-established along the river where there is lacking today. Variation in tree-species helps to increase diversity and the use of native bushes and trees builds on and strengthens the existing diversity. It should be considered to re-establish a zone of natural herb-/swamp vegetation alongside the river, as such transition zones are important for the living environment.

We propose planting native species as Hazel/Hassel (*Corylus Avellana*), Willow/Selje (*Salix Caprea*), Rowan/Rogn (*Sorbus Aucuparia*), Buckthorn/Hegg (*Prunus Padus*), Honeysuckle/Leddved (*Lonicera Xylosteum*) and rosebushes which are common along Akerselva.
As a part of opening up the Vaterland Park to its surroundings, the existing linden trees are proposed to be replanted in an irregular pattern across the park to gain openness across. The trees will function as the “top layer” in the wide planters, having layers of ground cover and bushes added to them.

Following are a few examples of the uses of local plants, as habitats or food source for insects, birds and mammals:
- Rowan/Rogn (*Sorbus Aucuparia*) can provide an abundance of fruit for wildlife. It is tough plant which birds adores, and it has 28 associated species of insects.
- Buckthorn/Hegg (*Prunus Padus*) The fruit is fairly bitter, but the birds don’t seem to mind.
- Linden tree/Lind (*Tilia Cordata*) Have sweet leaves and flowers rich in nectar with delicious smell which are a magnet for bees.
- Turkish rocket/Russekål (*Bunias Orientalis*) is a very vigorous and tough creature. It’s edible, with mild cabbage flavour.
- Elderberry/hyllebær (*Sambucus species*) serves nectar and berries to birds and humans.
- Roses/nyperoser (*Rosa Rugosa*) serves as shelter for birds and small mammals, general nectar source, fruits and fragrance.

ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **biodiversity on site and immediate surroundings**

examples cool climate / norwegian / local


Willowherb *Epilobium angustifolium*


Cow Parsley *Anthriscus sylvestris*


White sweet clover *Melilotus albus*


Turkish Rocket *Bunias Orientalis*


Cursed tistel *Circium arvense*


Plantain Lillies *Hosta*


Corydalis *Corydalis Lutea*


Common fern *Drypterix Filix Mas*


Geranium and Artemisia


Linden tree *Tilia*

examples Akerselva - native plants


Rowan *Sorbus Aucuparia*


Buckthorn *Prunus Padus*


Roses *Rosa Rugosa*


Roses *Rosa Dumalis*


Honeysuckle *Lonicera xylosteum*


Birch *Betula Pubescens*


Willow *Salix Caprea*

ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **biodiversity in building**

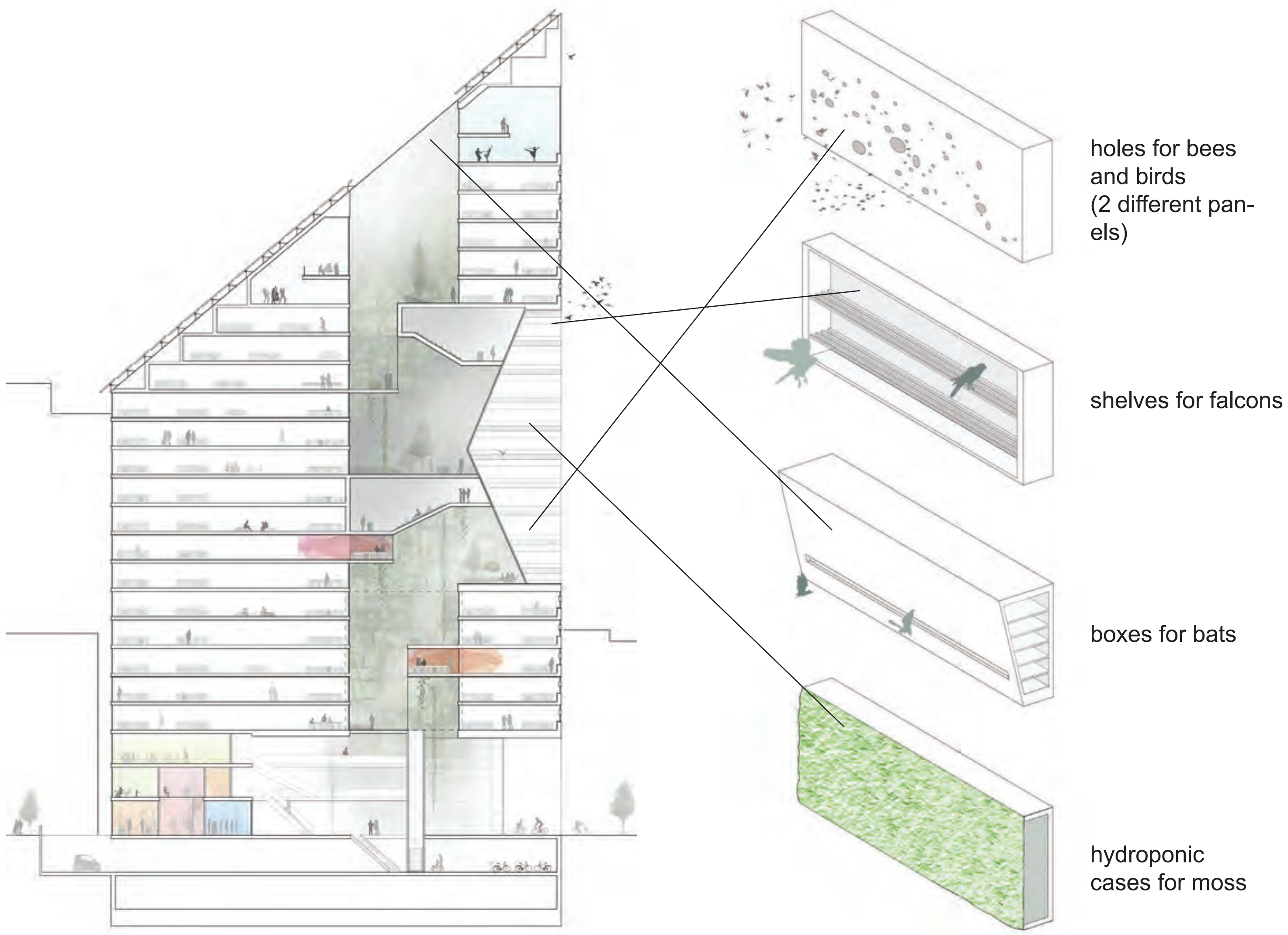
In building:
Strategy: To make a unique, green cave which performs both as a symbolic feature and as a supportive part of the building's technological system for air/heat/ etc.

The north/north-west facade of the outer shell of the building can no longer use the energy from the sun, thus the solar cells/panels are switched to green, living panels of moss. The façade caves in to form the atrium; becomes the walls of the building's urban grotto; and can be seen from both main facades, turning the inside out. As the inner walls of the grotto have different orientations and are at different levels in the building, this could be a starting point for making several, varying micro climates.

Though visually continuous, the walls of the grotto are separated with glass to create a green atrium inside (not heated) helping the ventilation system, and a green outside where façade panels are designed for birds, bees and bats to live.
Outside, planted surfaces can often provide good thermal insulation since pockets of still air are formed between the plants giving the same effect as a fluffy fur coat. Plants also reduce the effects of wind infiltration into the underlayer.

The use of climbing plants inside can increase warmth and perform as sound insulation, and protect wall materials. Green plants bind and break down gases such as nitrogen oxide, carbon dioxide and carbon monoxide and produce oxygen.
A combined leaf surface of 150 m2 produces the oxygen needed for one person. A 150m2 roof that has a 100 m2 leaf surface per square meter thus provides for the equivalent of 100 people.

inhabitatable panels of the facade:



We propose three types of vertical planting in/on the building:
The flat: panels with moss both inside and outside as cladding: *Hylocomium splendens* and *Rhytriadiadelphus squarrosum*.
The more voluminous: living green walls: panels of plants grown vertically using hydroponics, on structures that can be either free-standing or attached to walls. They are intricately planned collections of plants held in a structure away from the building.
The wired: climbing plants.
The floors of the different atriums/caves will be built up with planters similar to the ones outdoor.

Façade panels designed as habitat for birds, bees and bats are placed where the conditions are presumed to be agreeable for them in the "entrances" to the cave. They have different needs and can form different habitats in each corner. Falcons would use shelves high up (as on Tate Modern in London), and nesting birds would need more sheltered homes formed as holes into the panels.
There are twelve bat species in Norway, whereas six are endangered, and they all are protected by law. They preferably nest in buildings, where they enter through already existing cracks. They do not do any harm on structures though, and trying to create a nesting habitat as part of the warm side of the grottos would be a bio-diversity investment alongside Akerselva not done before.

ECO-EFFICIENCY

ENVIRONMENTAL PRINCIPLES OF THE CONCEPT - **biodiversity in buliding**

examples ground cover / panels


Bracken Common *pteridium aquilinum*

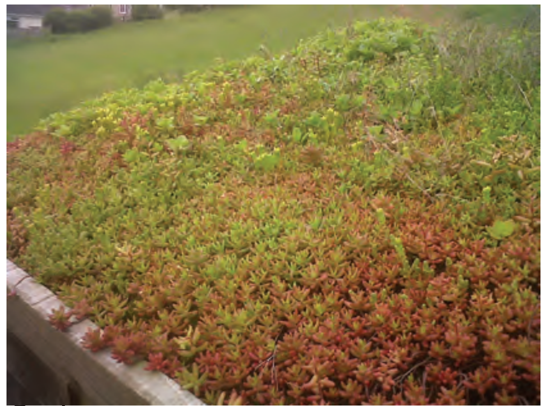

Festuca Ovina


Moss *Hylocomium splendens*


Moss *Rhytriadiadelphus squarrosum*


Roseroot *Rhodiola rosea*


Scotch Heather *Calluna vulgaris*


Sedum


Semper vivum


Stinging nettle *Urtica dioica*


Timothy grass *Phleum pratense*

examples climbers


Ivy *hedera helix*


Honeysuckle *Lonicera pericymenum*


Hop, common *Humulus Lupulus*


Virginia Creeper *Parthenocissus vitacea*

A few examples of the climbers:
Self climber: Ivy (*Hedera helix*) grows in shade up to 30 meters and is evergreen.
Trellis climber: Common hop (*Humulus lupulus*) or Common Virginia Creeper (*Parthenocissus vitacea*) grows to be ten meters high in sun and shade. Honeysuckle (*Lonicera pericymenum*) grows in sun, up to ten meters. Blackberry, bramble (*Rubus fruticosus*) can also be hung, 2-3 meters max height, sun.

ADAPTABILITY TO CLIMATE CHANGE
Adapting building designs for climate change is about managing the unavoidable. While there is debate around what level of adaptation is needed, there is growing awareness that design practices need to take into account predictions of increased risk and intensity of extreme events.
The proposal recognises that the nature of weather events is unlikely to remain the same throughout a building's lifetime.

Challenges we see in the future:
Rising temperatures - impact on external surfaces, and the thermal performance of building:
The atrium/inner cave will be a possible regulator and a place where structural changes or planting strategies can be made.

More intense rainfall - greater intensity of runoff: issues of structural integrity; drainage; opportunities for capturing rainfall:
The atrium/inner cave opens to the sky where plants on roof will help drainage. Water run-off from roof is collected and used internally in the building and excess water is led into pools for drainage in the Vaterland park.

Increased humidity – mould, condensation, decreased thermal perfomance of building:
Solutions in flexible ventilation systems and separate layers of the façade which makes elements demountable and thus being able to change parts of damaged construction.

ARCHITECTURE
cityscape

Form
The building is shaped to collect maximum energy from the sun to produce electricity. The V-shaped plan plan folds out to make facades for solar voltaic panels exposed to sun from early morning to late afternoon, and at the same time open up for green lungs facing north for natural air conditioning and daylight.

The tilted roof is also covered with photovoltaic panels. Angled 40 degrees and faced directly south, the roof receives a maximum of sunlight during a year in Oslo. Southeast and southwest facades have photovoltaic panels and sun collectors in an optimized angle for sun-exposure and at the same time creates shading for the interior.

The roof of the building is placed right above the shadows of the two tall buildings south of the site, making the building 95.5 meters and 25 floors high. This height was weighted to give the best ratio between sqm façade for energy production and sqm heated floor area (BRA). Lowering the roof too much and the photovoltaic panels are overshadowed. During the process of bettering the concept, we now see a potential for adding sqm and still be covered the need for energy.

Cityscape
The height of the building makes it a part of the cluster of high-rise buildings in the center of the city. The tilted roof gives the skyline a distinct member that "softens" the appearance of the two others. Being lower than the two existing high risers, it works as a mediator between the tallest buildings and the general height of the city. Illustrations show that the tilted roof in a formal way appears to works together with the top of the Radisson Plaza.

Office space
The office space have good daylight conditions. Green lungs located in the center of the floorplan give good conditioning of the interior climate. Both daylight and the air conditioning lungs play an important part in the environmental concept of the building, reducing the energy demand for lightning and cooling, and providing offices "freshness".

Research show that daylight have good impact on health. We also believe that the closeness to the city, by having workspaces close to the windows, affects work environment in a positive way.

The green lungs are in the center of the building and in center of all activity. The lungs work as places of shared functions, interaction and inspiration. The shared function include small auditoriums, meetingspaces, leisure garden and other shared facilities (social/cultural).

The typical floorplan is organized in three main zones, each with its own distinct quality. The two wings have different width and offer different qualities and possibilities. The wings meet in an area well suited for an office landscape with large windows facing south giving light though shaded by the tall buildings south of the site.

The V-shape of the typical plan and the good daylight conditions, give a truly flexible plan with no zones that is reserved only for open office-landscapes or functions with no daylight requirement. A good, flexible floorplan with a lot of daylight and fresh air is reducing the risk in the project. Flexibility, fresh air, and daylight will always be highly valued qualities in an office.

Snow and ice
During the winter, snow and ice which doesn't melt right away on the roof, is stopped from falling of the by snow-stoppers along the edges. The tilted parts of the south east and south west facades do not collect water in gutters. The idea is to let the water run freely and thereby not form icicles. The angle of the facade panels is steep enough to not hold snow, so all snow will immediately slide of.
In case some icicles will be formed, there is a 4m brim along side the façade that protects the public from falling icicles.

Retail
The first two floors have shops, cafés, restaurants and pubs. The subdivision of these are as narrow as possible to fit in as many as possible facing Vaterland Park. The two sided access make them accessible for users of the building and the public outside.

Entrance
The entrance is a part of Lilletorget. The office building is "lifted" three floors to make space for an airy and generous urban lobby with bike-parking, small scale retail, art-space and a prominent office entrance. The floor of this space has the same paving as Lilletorget.

UNIVERSAL DESIGN
The proposed building and its surroundings is designed with the idea that the building provides a universally designed work environment that is universally connected to the surrounding city and the Central Station.
The project can be used in promoting universally designed urban developments for the new station-citys outside the city center as well, making green mobility universal. We suggest a focus on universal design on three levels:

The floorplans
The V-shaped floorplans allows for simple and intuitive use, featuring:
- A clear organisation with clear lines of sight
- Rounded off corners in the corridors
- Lobby in close connection to the elevators
- All columns at the perimeters to ensure maximum flexibility
- Use of contrasting colours and textures to make elements more visible
- Use of both tactile and perceptible information boards
- A central point of activity and orientational marquer in the "green lungs"

The street level.
- A defined entrance with a clear connection between lobby and the street
- Make the lobby a part of Lilletorget by using the same kind of surface in the lobby as on Lilletorget
- We suggest that the car lanes in Stenersgata is "cut" by Lilletorget and made as a shared space to lower the physical effort in crossing the Stenersgata and improving the connection between the building and Brugata.

The urban surrounding
We suggest that the project uses the potential the site has for a universally designed connection of the Central Station with Brugata and the Akerselva river. By making a universally designed connection to the Central Station, with the lowest possible physical effort, the 31000 m2 building is made accessable for a large number of people living in and around Oslo. Imagine a person in wheelchair living in a future Kolbotn: The person can work in the building and travel by train, shop groceries in Brugata and have lunch at the riverside one fine day in the springtime.

MARKET & ECONOMY
Although the building has strong innovative features, and a shape that is optimized to make the technology of the environmental concept work, the typical floorplan is not challenging the general idea of what a good office space should look like. Nor are there elements in the structure that make the building significantly more expensive than a conventional building. The technology used is available and evolving rapidly. Solar voltaic panels are getting more affordable and recycled steel and aluminium is easier to get by.

In calculations in this first phase we have seen that there is a potential for further energy production. We see that this can be taken advantage of to increase the sqm of the project with 20% and still being able to deliver within the goal of 2 kWh/sqm year.

More m2 increases emission, but decreases emission
For this stage of the competition we have not calculated the environmental effect of the increased m2 taken into account the close proximity to the Central Station. What we know, is that there is a substantial environmental effects of central nodal point developments. Norwegian Institute of Transport Economics recently did a research on Bjørvika called “Environmental effects of central nodal point developments”.
The research concludes: “..*that central nodal point developments generate far less car traffic compared to development in more peripheral areas in the urban structure. In the concrete analysis we found that construction of office buildings for 12.500 jobs in Bjørvika will save Oslo 7.3000 car trips and 104.000 km by car per day compared to locating these work spaces similar to the current distribution in Oslo. This saves 12 tonnes CO2 emissions, 20 kg NOx emissions and 7 kg NO2 emissions a day, as well as 18 MWh of energy for transport.”*
The reduced emission following more m2 on this particular site could be a discussion worth taking.

ARCHITECTURE

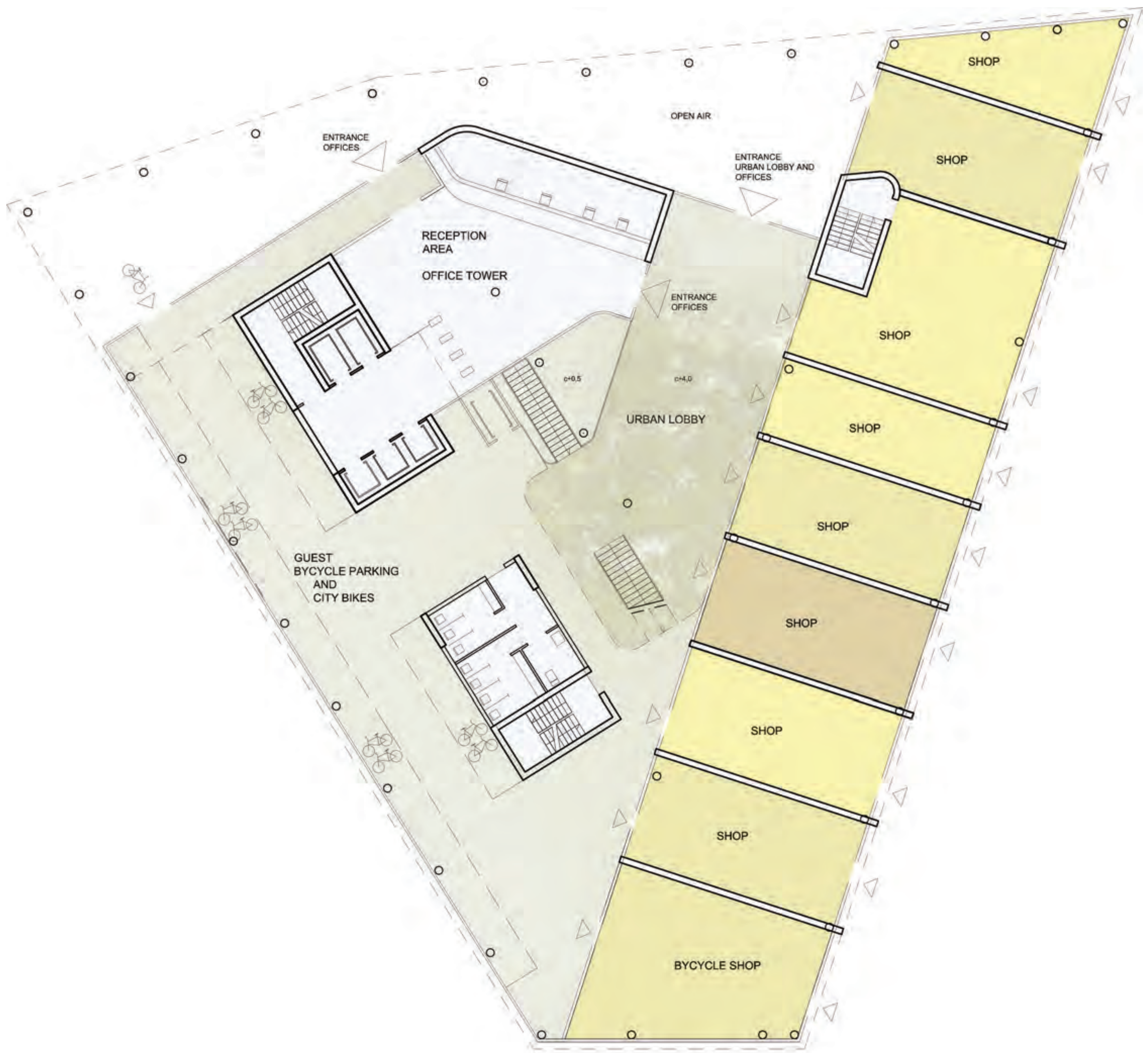
ground plan 1:300 and 1:500 (A3)

Today, the bicycle path coming from east *ends* at Lilletorget. Oslo is far behind on making bike routes throughout the city, but the focus is there, and this building is ideal as a junction and citymark for bicyclists and a new era in city planning for as a whole.

People living on the east-side (Gamlebyen, Nordstrand, etc) biking to work, pass this point before scattering all over the town. The site is ideal as a place where “you tank up” before going home; the building entrance connects with Lilletorget while the shops and restaurants open both to the lobby and the park.

Imagine riding from Nordstrand in the morning, parking your bike to get it fixed at the Oslosolar, take the metro to work, pick it up on your way home together with som fresh fish from Fly-vefisken.

BASEMENT -1



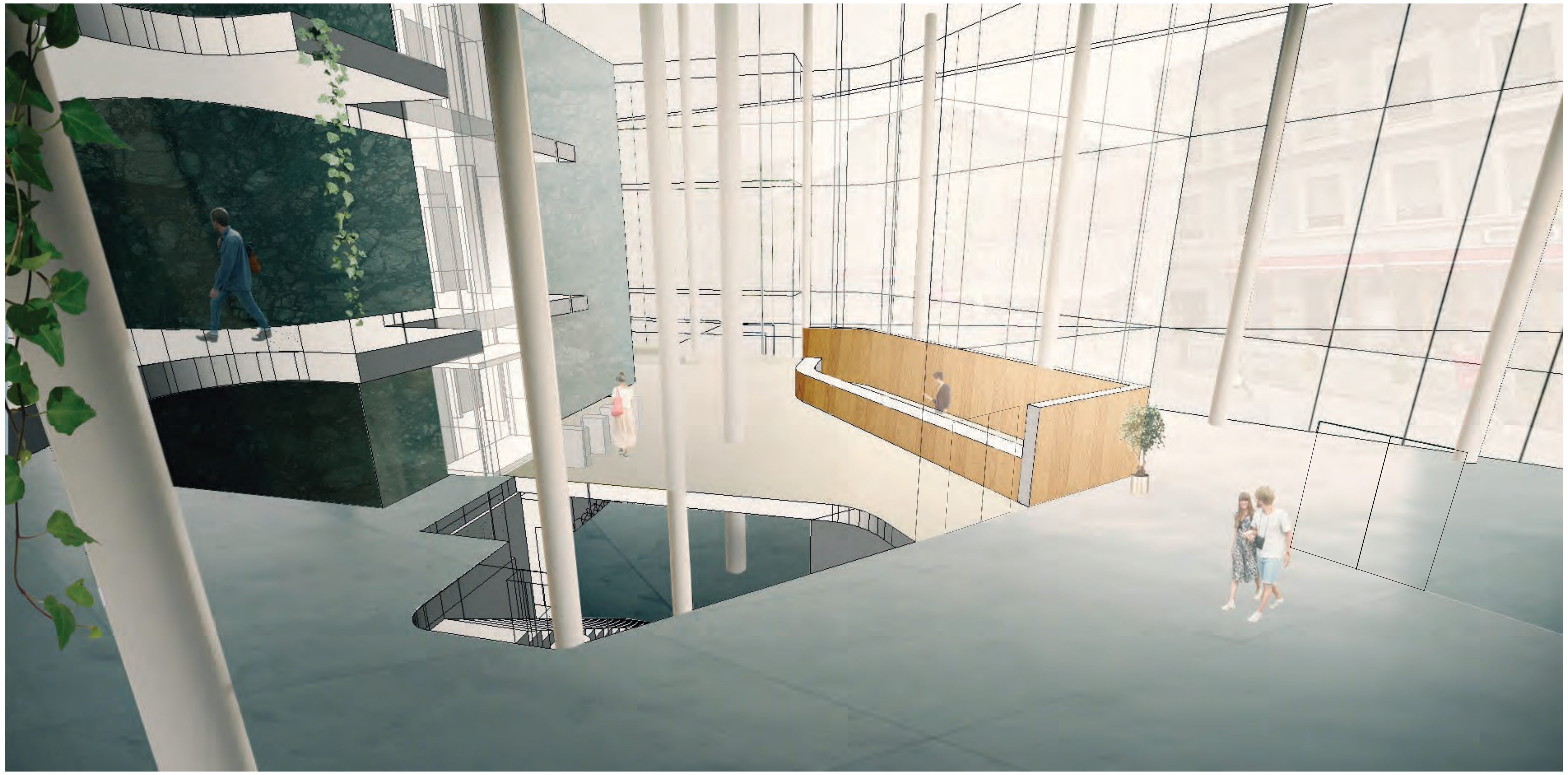
GROUND FLOOR

ARCHITECTURE

floor plans 1:500 (A3)

1st FLOOR

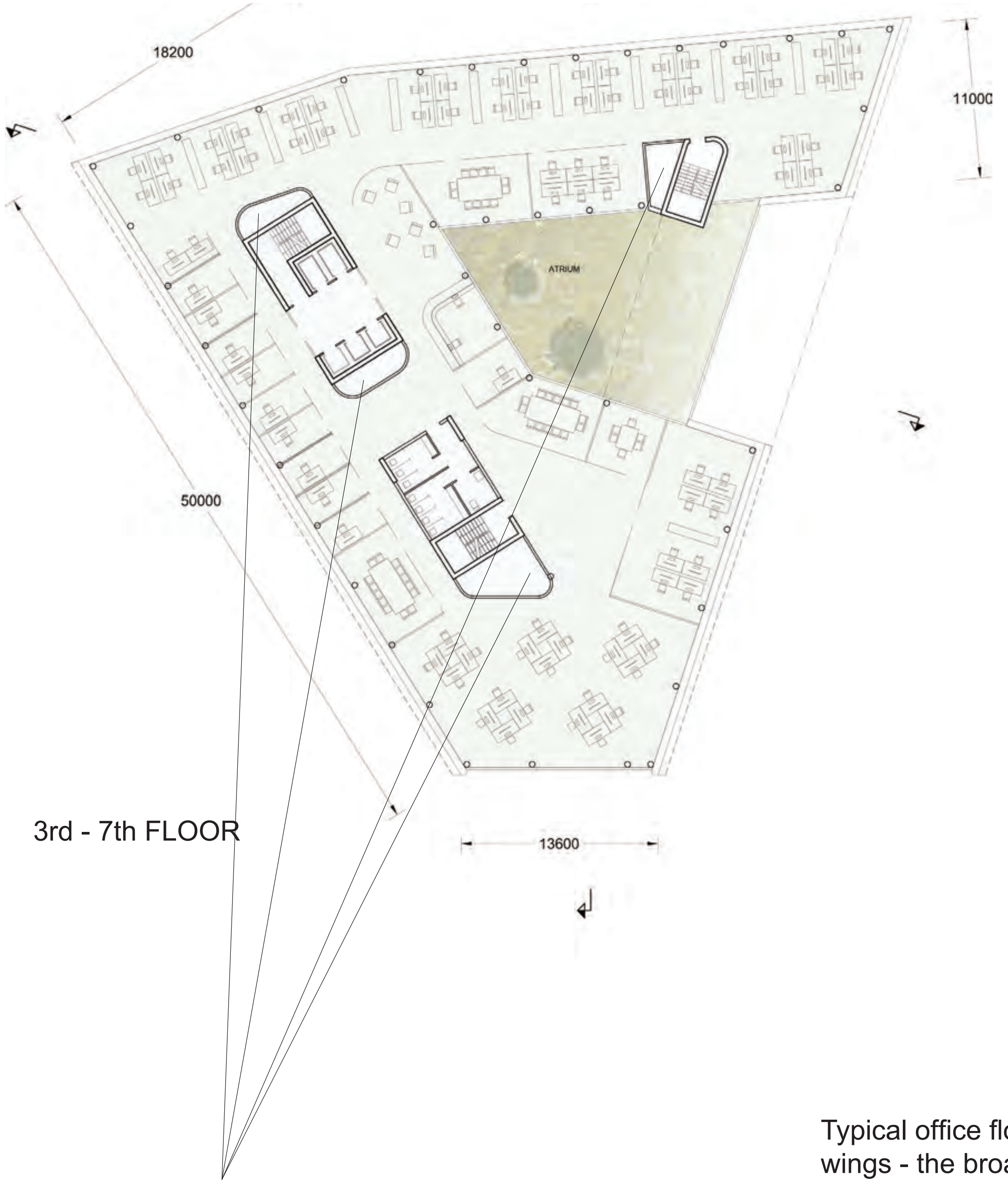
2nd FLOOR



View from the first floor gallery, looking down at the floor of the urban lobby and Lilletorget. The lobby is a heated balloon in the non-heated lobby, so that the entrance via the bicycle basement can be open and a part of the volume.

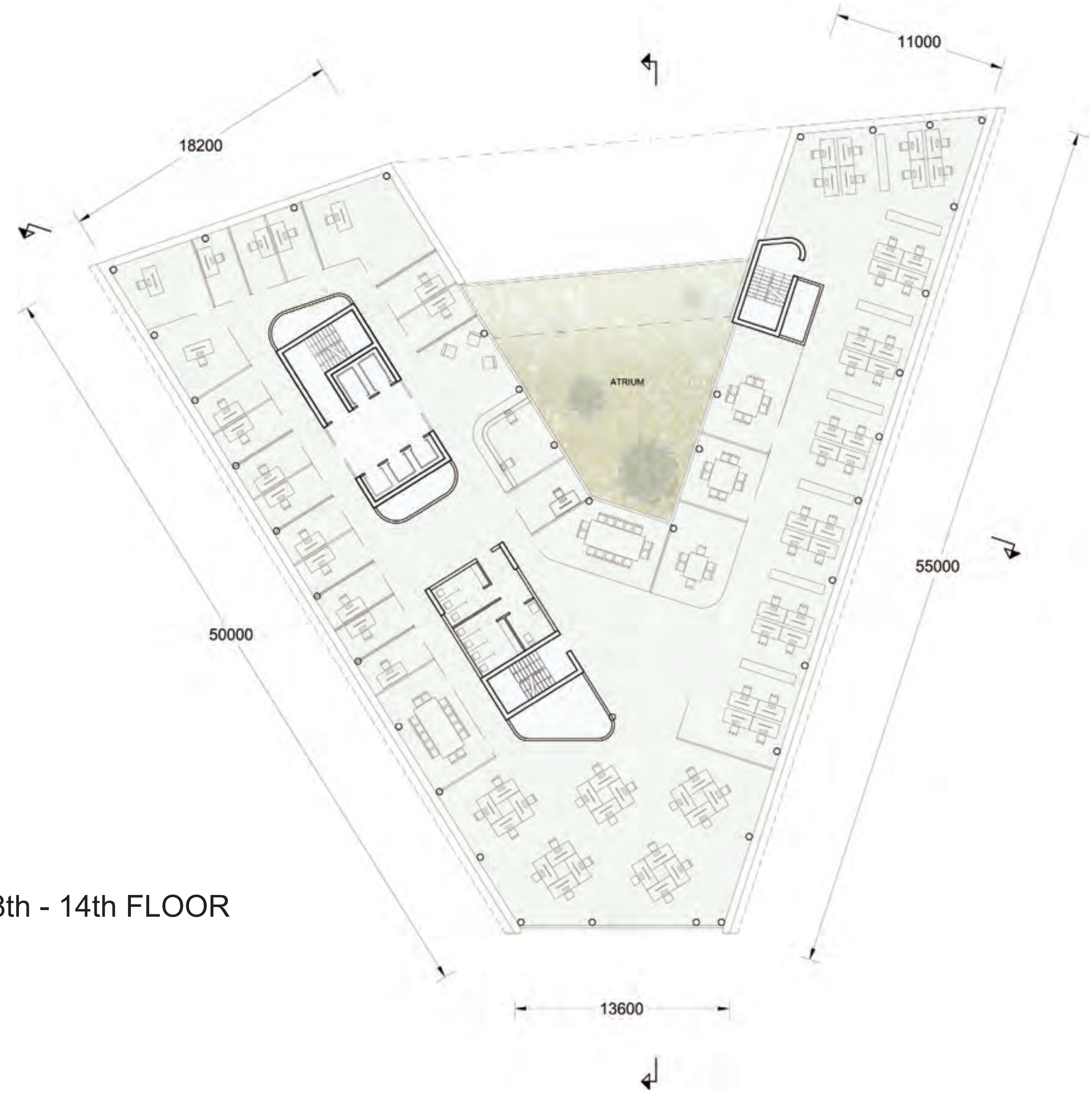
ARCHITECTURE

floor plans 1:500 (A3)



3rd - 7th FLOOR

AHU

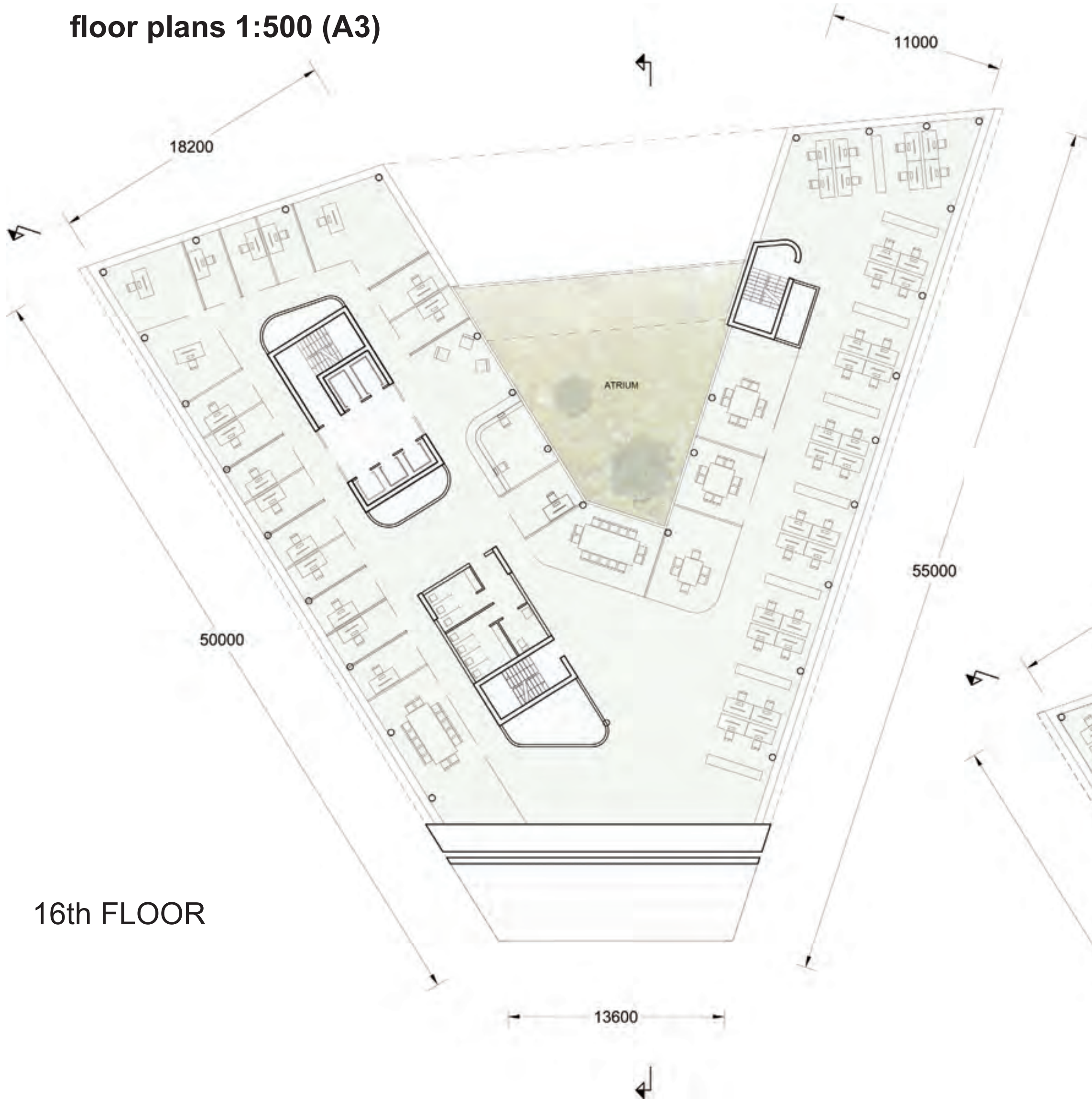


8th - 14th FLOOR

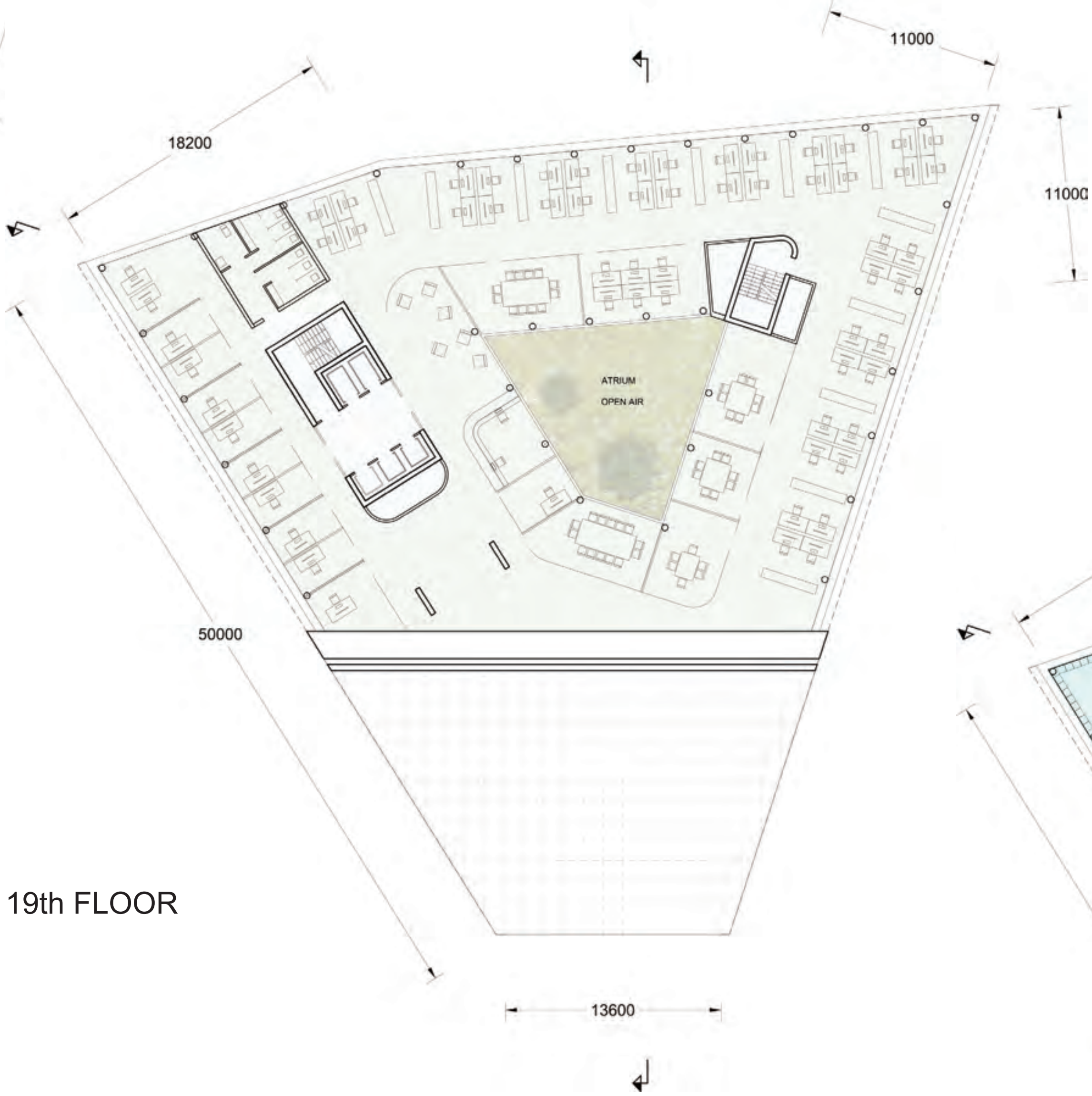
Typical office floor plans showing the two different wings - the broad with a central core and the narrow which is daylit from both sides.
The plans are oriented around the atriums with decentralised units for airhandling (AHU).
The glassfacade to the south permits furnishing deeper into the volume.

ARCHITECTURE

floor plans 1:500 (A3)

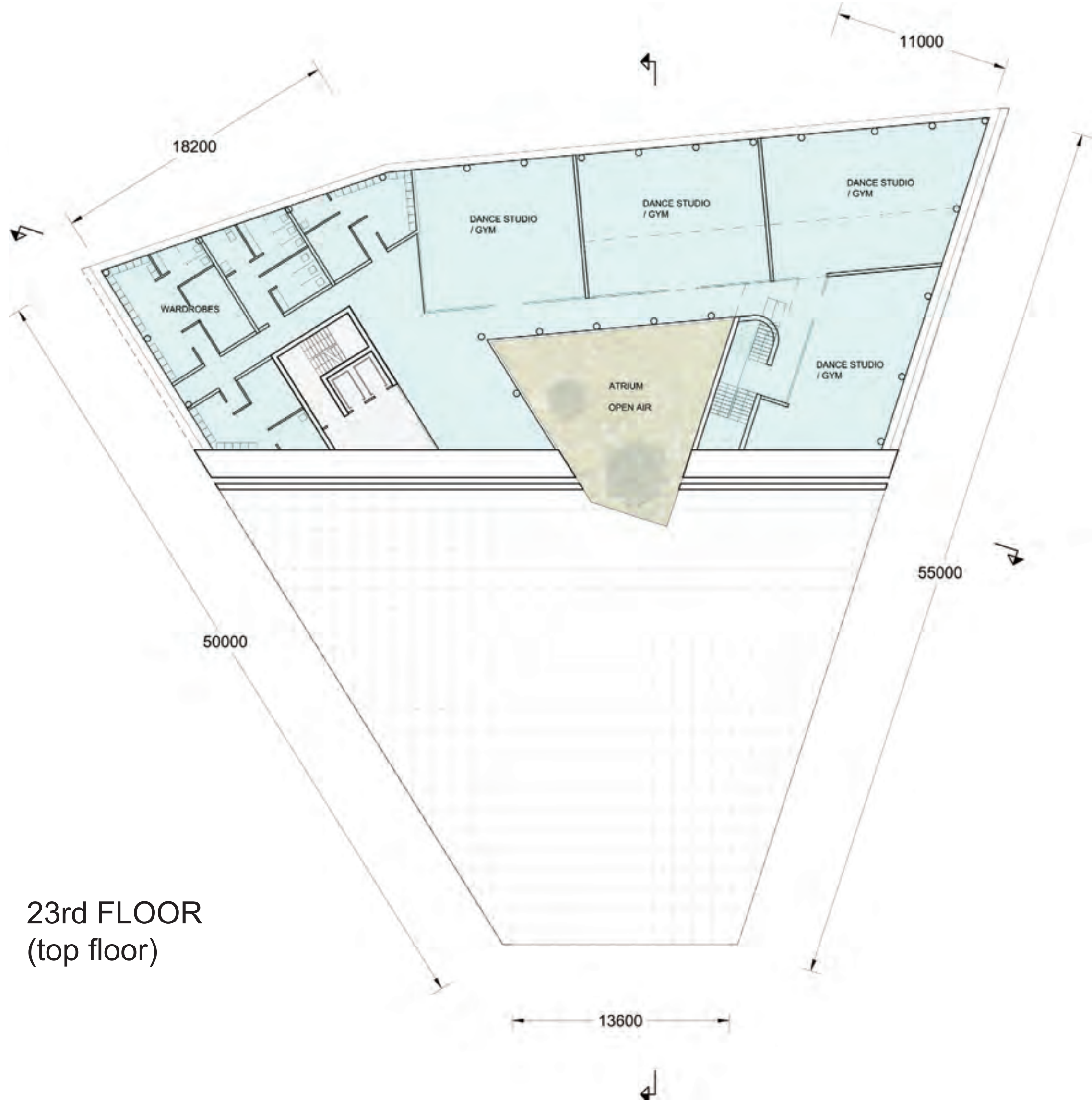


16th FLOOR



Top floor is a public floor, with program of activities - dance studios, gym, etc. Above the top floor there is a mezzanine with extraordinary views of the city.

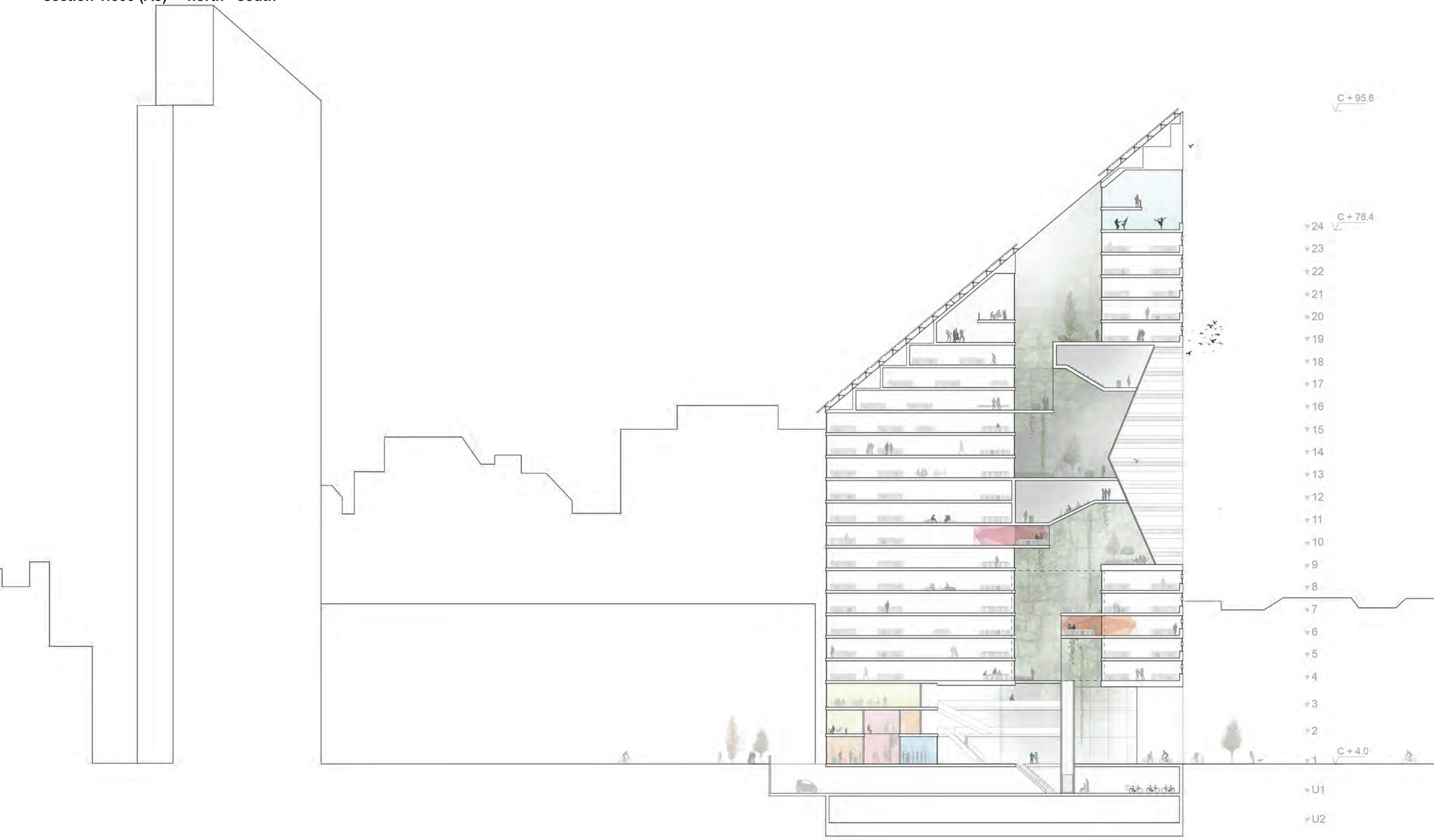
19th FLOOR



23rd FLOOR
(top floor)

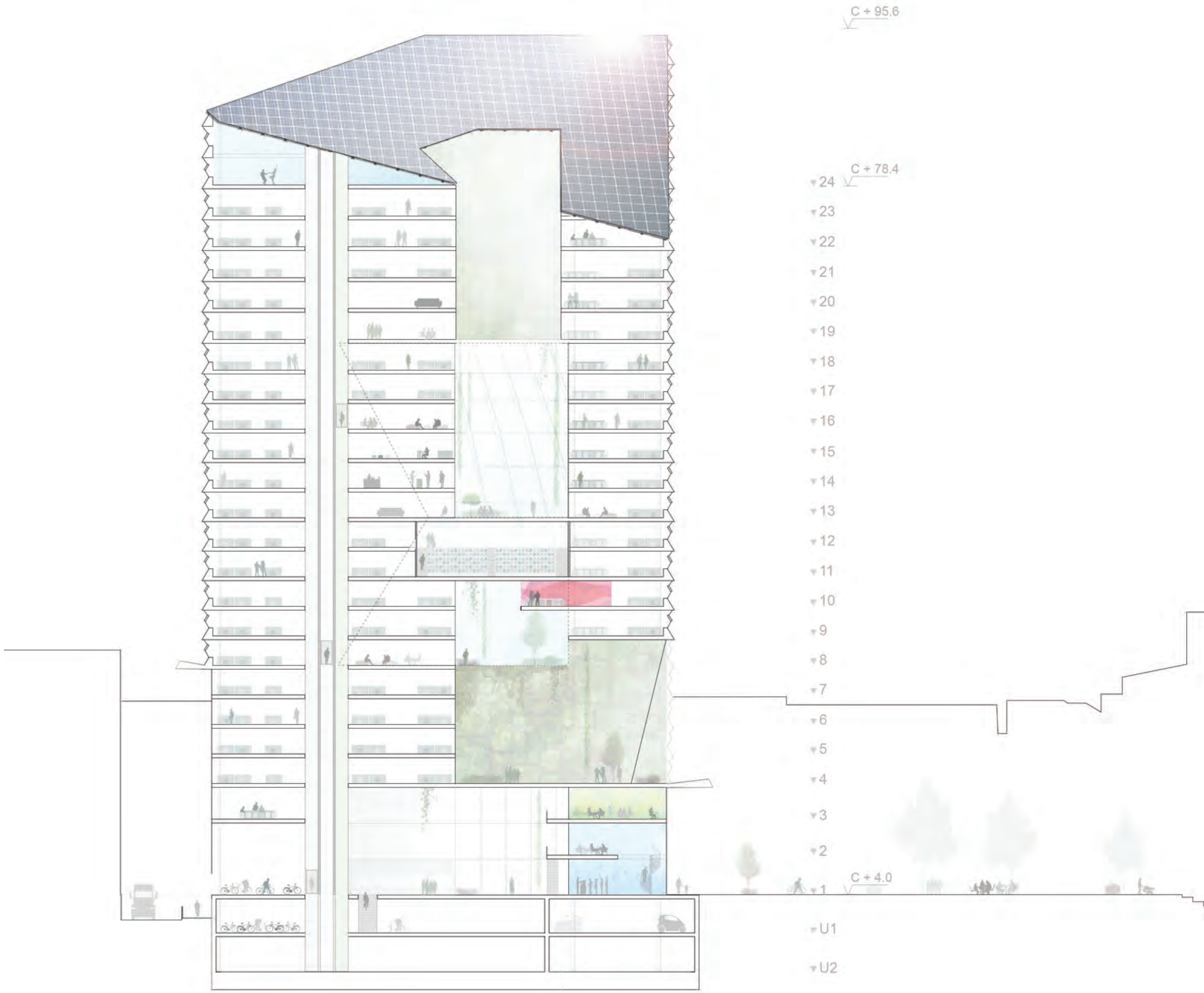
ARCHITECTURE

section 1:500 (A3) north - south

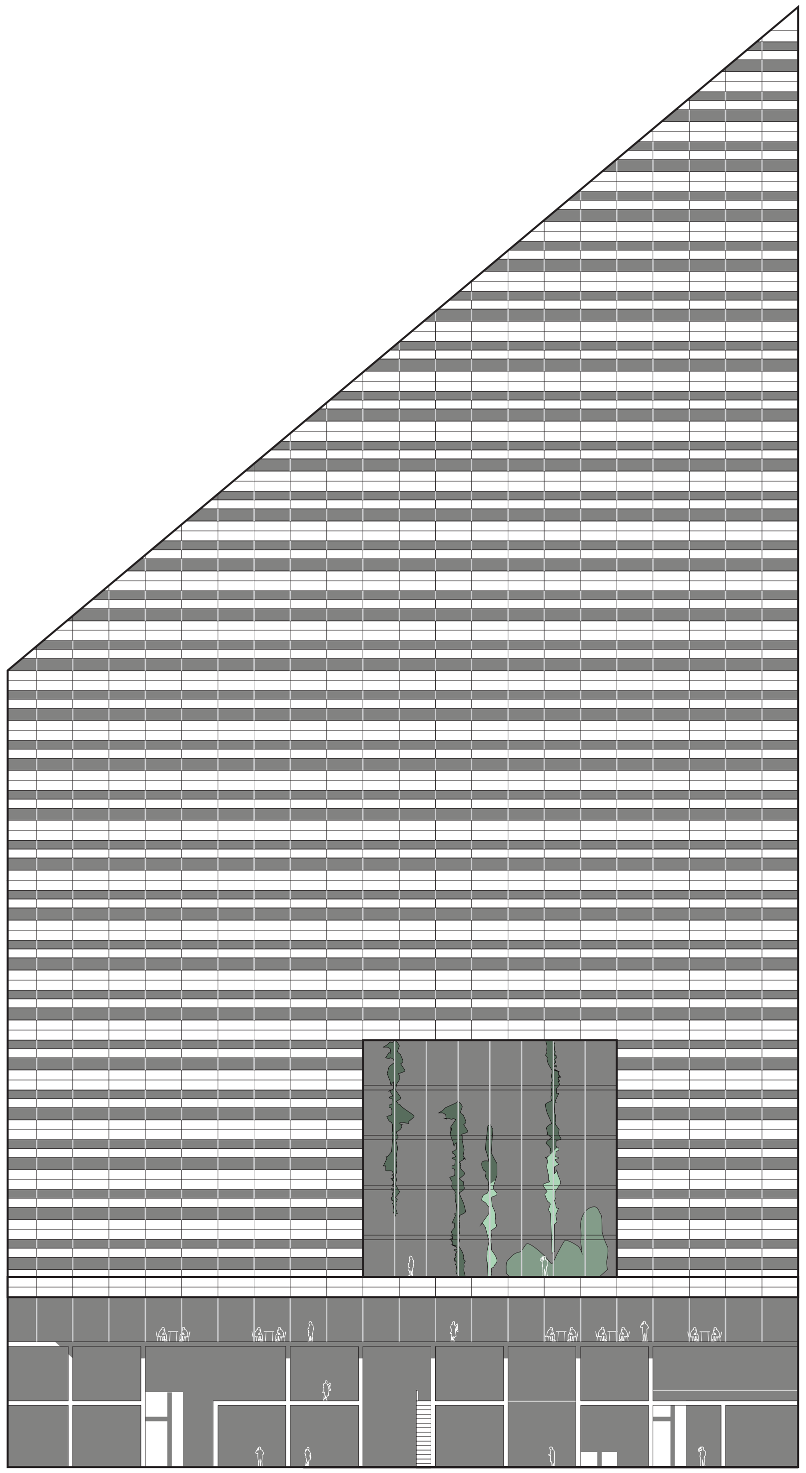


ARCHITECTURE

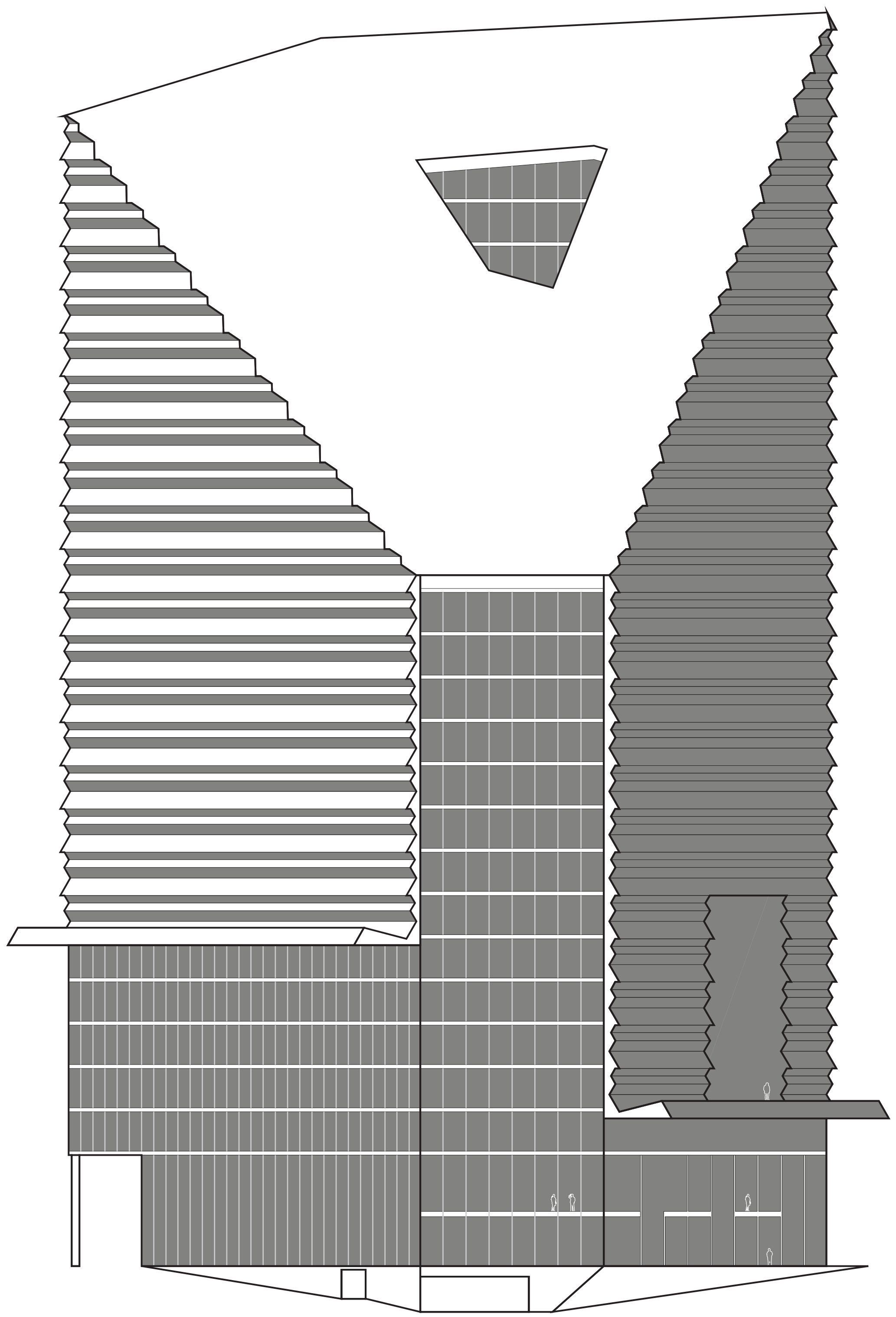
section 1:500 (A3) east - west



ARCHITECTURE
facades 1:500 (A3)



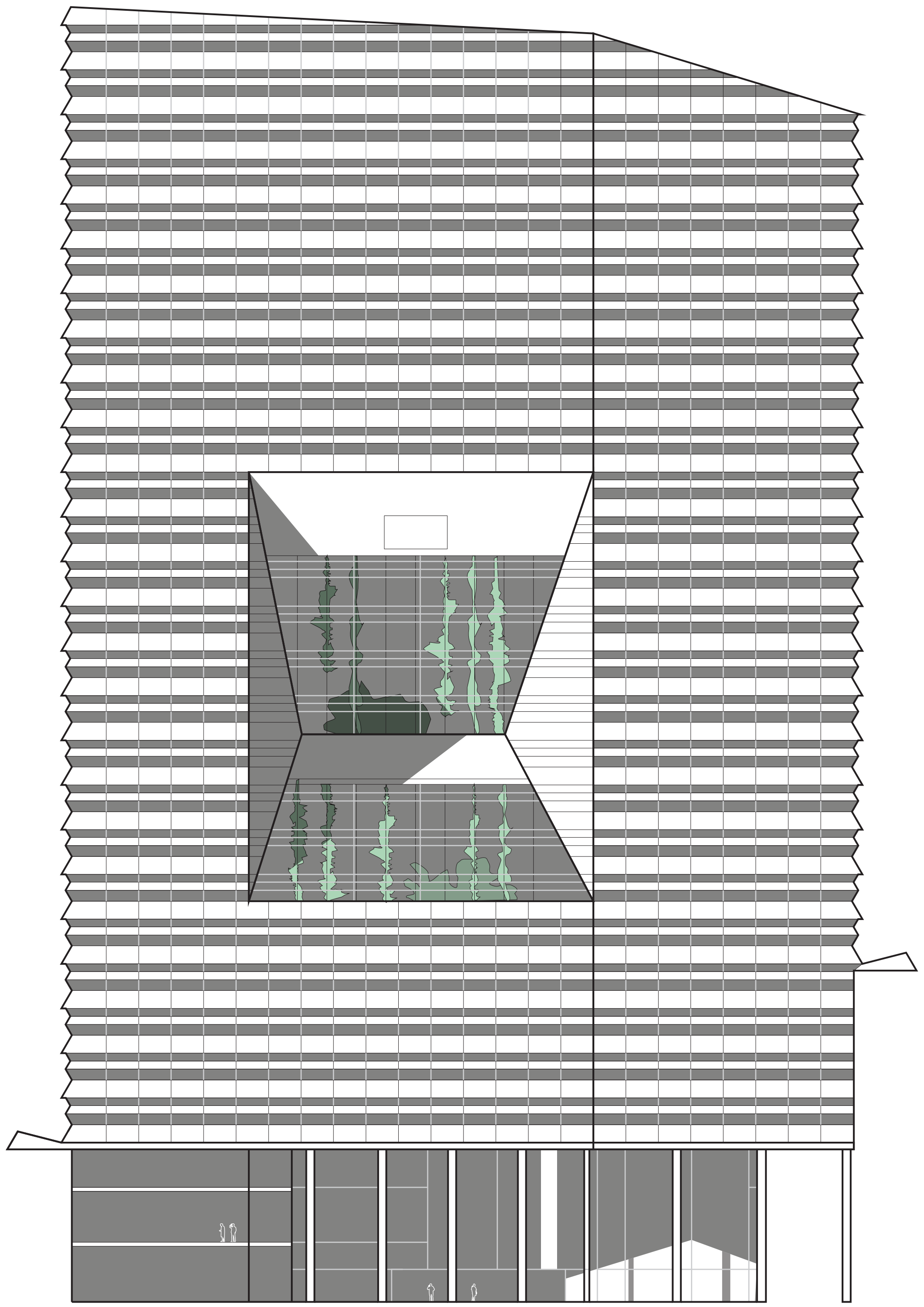
EAST



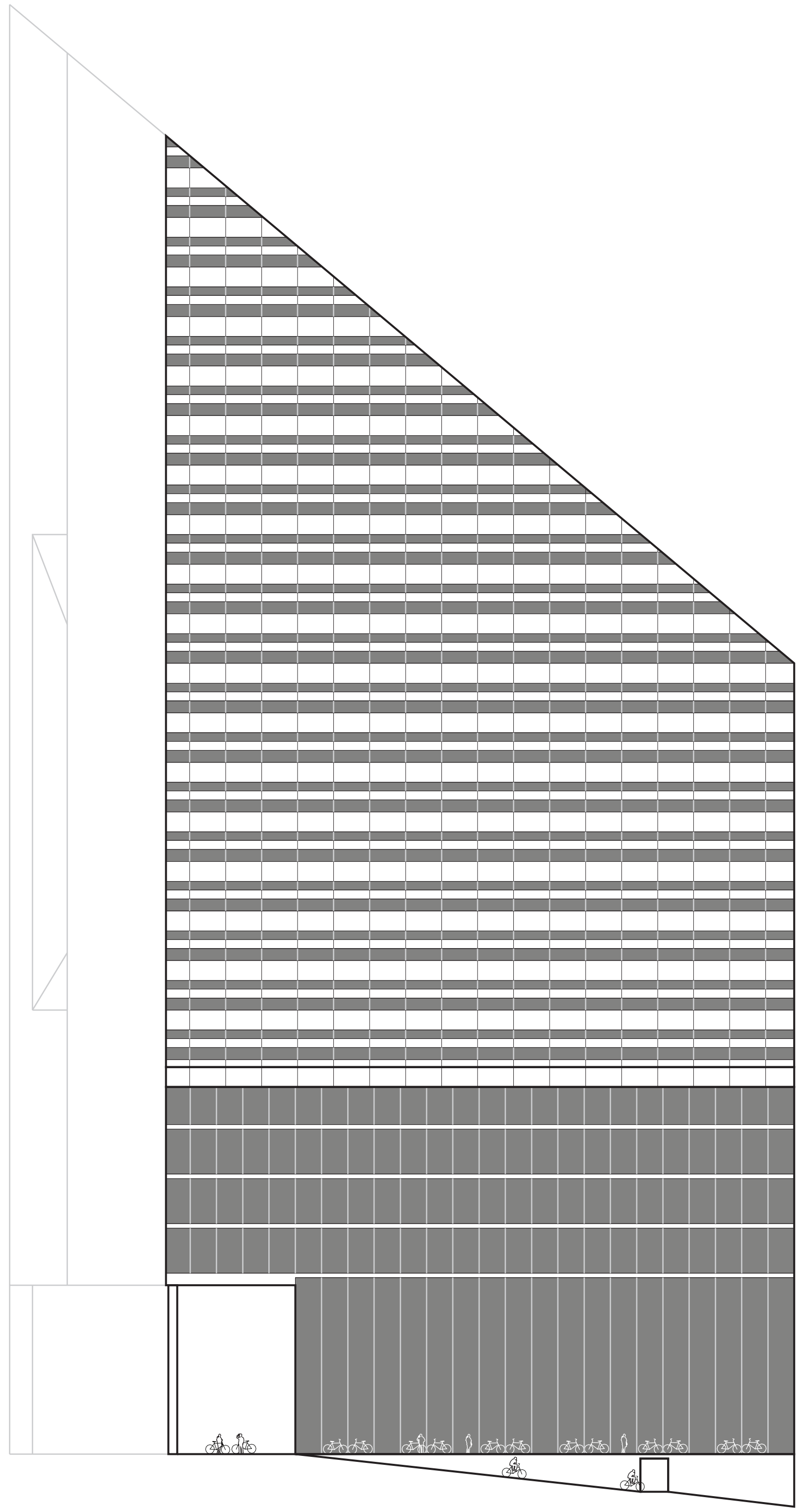
SOUTH

ARCHITECTURE

facades 1:500 (A3)



NORTH



WEST