

Saint-Gobain ISOVER- Multi-Comfort House Students Contest 2016- Brest, Belarus



Croatia 1st prize
inhabiting treetops

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modular sustainable passive housing, Brest, Belarus

research- context analysis- Belarus



- independence from USSR 1991.
- 1994. president Lukašenko- last european dictator- most loyal russian ally
- all media and most of the land are state owned
- relatively closed country
- Russian gas pipeline passes through Belarus
- a lot of resources are invested in sport and education

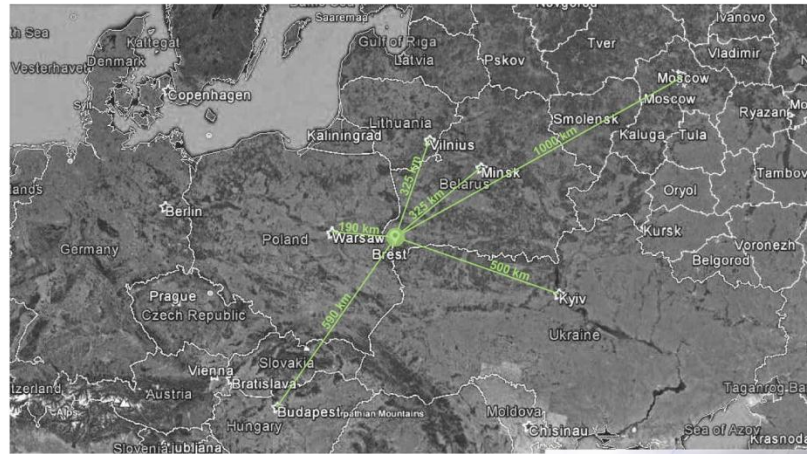


- population: 9 500 000 residents
- 70% orthodox, 20% catholics, 7% greek catholics
- 30% of the population lives in the countryside, and 70% of the population lives in cities
- 72% speaks primarily russian, only 11% belarus language
- although it is considered a closed state, residents are very open and liberal
- residents tend to the european way of life (popularisation of cycling)

- cherish tradition -pagan customs
 - traditional textiles
 - production of straw articles



- the most developed industrial center of USSR-a highly industrialized country
- large amount of residents engaged in hunting and fishing
- free use of highways



- no access to sea
- 3 biggest rivers: Niemen, Pripyat, Dnieper
- good connections by rivers
- many wetlands
- 11 000 lakes, 20 000 watercourses



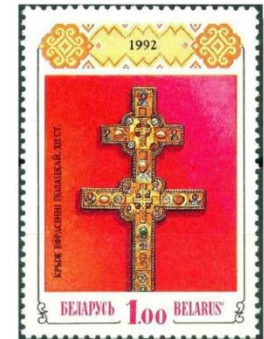
- St. Eufrosinia cross -belarus masterpiece
 - disappeared during WW II
 - was never found



- area: 207 595 km²
- mostly lowland country
- temperate continental climate
- 90% of country covered with greenery
- oak, birch, conifers, pine woods cover 40% of the country



- pitoresque villages slowly decaying, residents move to towns
- existing buildings in cities are energy inefficient
- building materials used: 38% prefabricated concrete components, 35% brick, 25% wood
- 90% of built houses are mass prefabricated buildings



research- context analysis- Brest



- name Brest comes from birch/ bark
- 6th largest town in Belarus
- capital city of Brest voblast
- 2019. celebrates 1000 years since founding
- population density: 3 966 residents/ km²



- local materials used in large amounts -granite
- sand
- clay
- limestone
- peat



- on Muhavets and Bug rivers
- on the other side of the river- polish town Terespol
- Dnieper- Bug canal connects Brest harbour with the Black Sea
- on European route E30 Berlin- Moscow
- important railway center -the last point of the russian track
- important transit town between European Union and Commonwealth of Independent States



- elevation- 280.4 m
- transitional climate between oceanic and humid continental
- record low temperature -35 °C, record high +36 °C
- average winter temperature -5 °C, summer +25 °C



- 19th century Hero fortress well known for combats during WW I and WW II
- located on island between rivers Mukhavets and Bug
- war memorial on site of 1941. battle -largest tourist attraction
- 1st outdoor railway museum
- archaeological site displaying an authentic East Slavic wooden town from 13th century, Brestye



- flat terrain- town in the river valley
- two rivers flow through the town: Bug and Muhavets
- Muhavets-during history caused large floods, 2-3 km wide
- now dams are built -calm, wide, slow river



- strong industry
- annual export increase 20%
- main industrial partners -Russia, Germany, Poland, Ukraine, Italy
- high tech agriculture
- tractor production -industry and technology
- growing meat and dairy products
- enterprisers use local resources
- extraction and processing of minerals



- 40% Brest voblast covered with forest
- large number of reserves in voblast
- north of Brest national park -habitat of the European bison
- large number of parks, forests and green areas inside town area



research- surroundings collage with existing forest area



concept- **general concept**

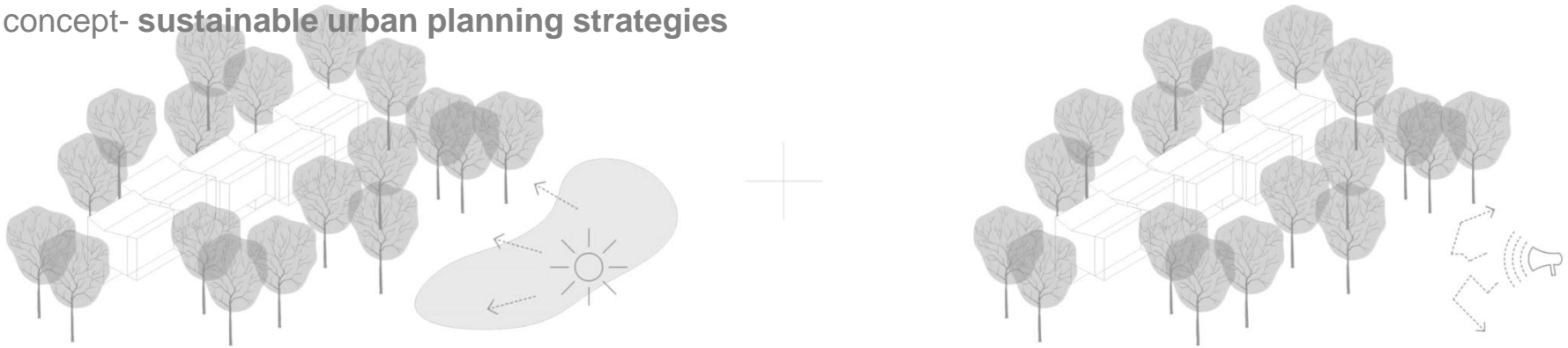


saving existing forest and greenery

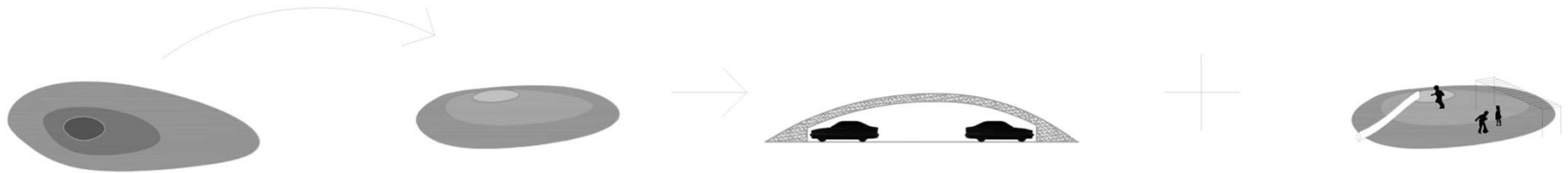
rising living area from the ground

inhabiting treetops!

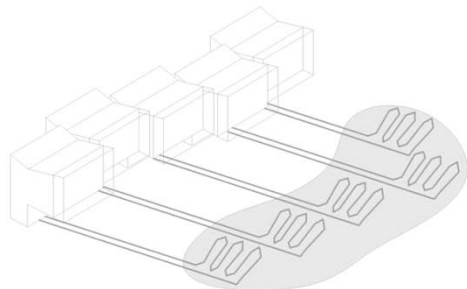
concept- sustainable urban planning strategies



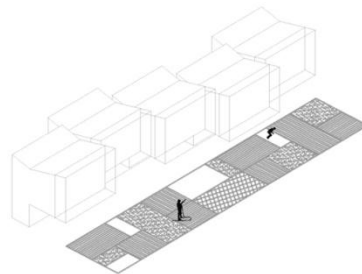
using forest trees as natural shading system together with on-site lakes to prevent overheating and also as natural sound buffer for creating pleasant living environment (+creating unique living-with- nature atmosphere)



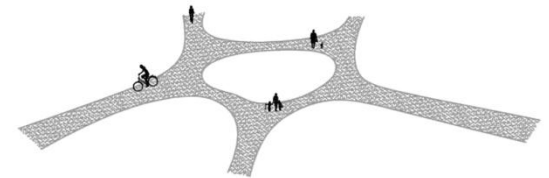
reusing excavated earth for creating topography, playgrounds for children and covering car parking (+minimum roads= less CO2); waste recycling points are placed in the ground-covered parking construction



using on-site lakes for water-water heat exchange







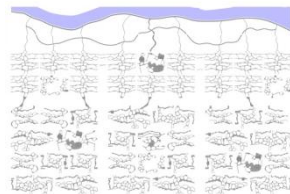




creating gardens for urban farming and growing own organic food



creating a strong network of bicycle and pedestrian paths to promote bicycle and pedestrian traffic and destimulate car traffic

general block masterplan



	rowhouse		market / post office / community center / infirmary / cafe / shop / pavilion		school		gym		walk and bike trails
	residential building		offices + cafes + shops + market		kindergarten		library		

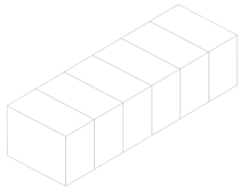
general block masterplan- aerial view



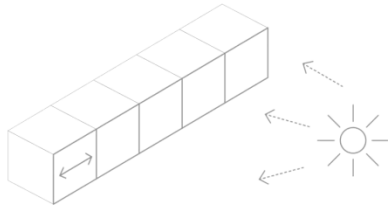
general block masterplan- rowhouse block rooftop plans



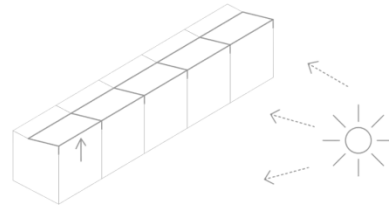
concept- rowhouse concept schemes



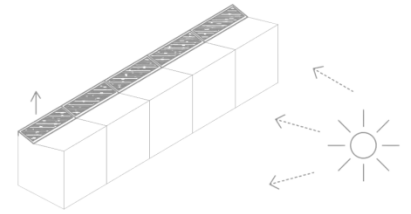
typical rowhouse



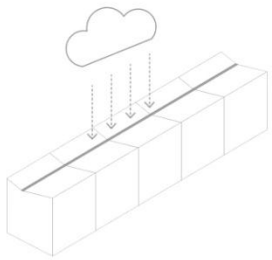
reorienting main facade to south (sun)



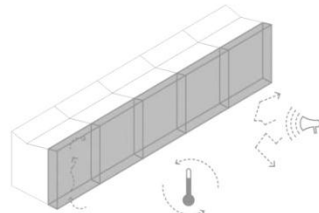
sloping south side of the roof for maximum sun penetration inside the house



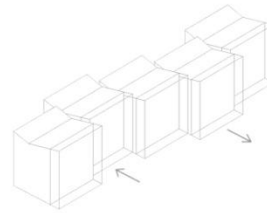
sloping north side of the roof for most efficient collection of solar energy



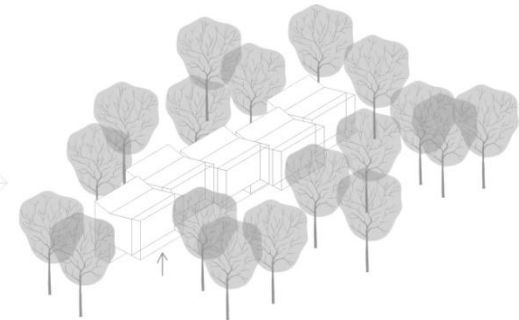
roof shape enables maximum efficiency of rainwater collection



creating multi-benefit buffer space



enabling higher degree of privacy



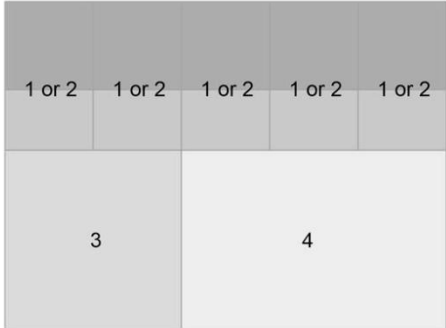
raising from ground- inhabiting treetops!

concept- rowhouse modular concept schemes

rowhouse functional zoning



module placement scheme



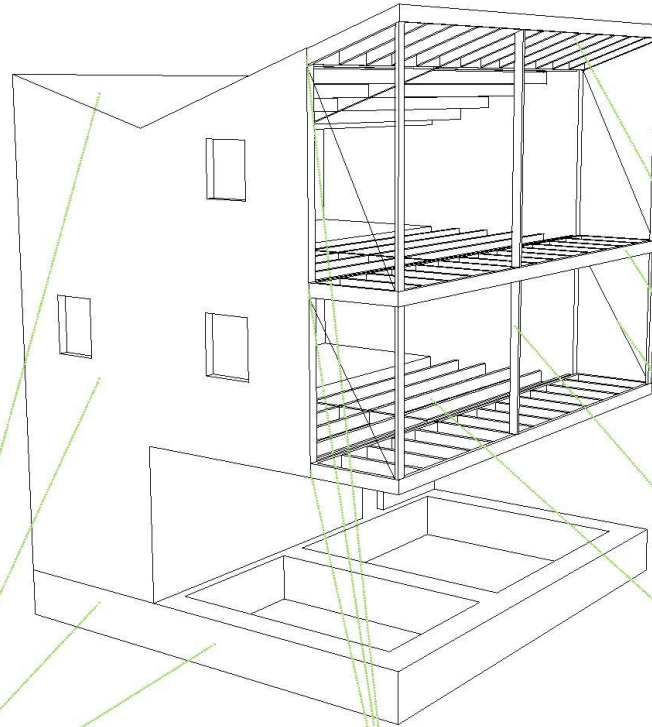
rowhouse modules can be adapted to fit the family temporary needs and can be changed through the time



concept- rowhouse module types catalog

module	module area	module types
1	3,00 m ²	1a- staircase 1b- elevator 1c- bathroom 1d- toilet 1e- toilet 1f- utility room 1g- pantry 1h- pantry 1i- pantry 1j- walk in closet 1k- study
2	5,20 m ²	2a- bathroom 2b- bathroom 2c- utility room 2d- utility room 2e- walk in closet 2f- kitchen 2g- kitchen 2h- office 2i- study 2j- study 2k- terrace
3	12,80 m ²	3a- dining room 3b- bedroom 3c- bedroom 3d- children's bedroom 3e- children's bedroom 3f- terrace / loggia 3g- children's bedroom
4	19,50 m ²	4a- living room 4b- living room + dining room 4c- bedroom 4d- children's bedrooms 4e- children's bedroom 4f- hole for double height space

rowhouse layers- loadbearing construction



loadbearing reinforced concrete structure -very low carbon footprint- 0,13



- roof slab 18 cm
- walls 18 cm
- foundation slab h= 50 cm
- foundation grid 60/90 cm



thermal break element

- allows thermally insulated connections between wood and concrete
- enables high level of prefabrication
- reduces thermal bridges, CO2 emissions and conserves natural energy resources

loadbearing laminated wood structure

- for every m³ of wood used instead of other material, approx. 1 tonne of CO2 is saved
- creates healthier environment
- is a recyclable material

- roof beam 8/24 cm; spacing 69 cm
- beam 8/24 cm
- steel wire tie $\varnothing= 28$ mm
- wood column 8/20 cm
- beam 8/24 cm; spacing 69 cm



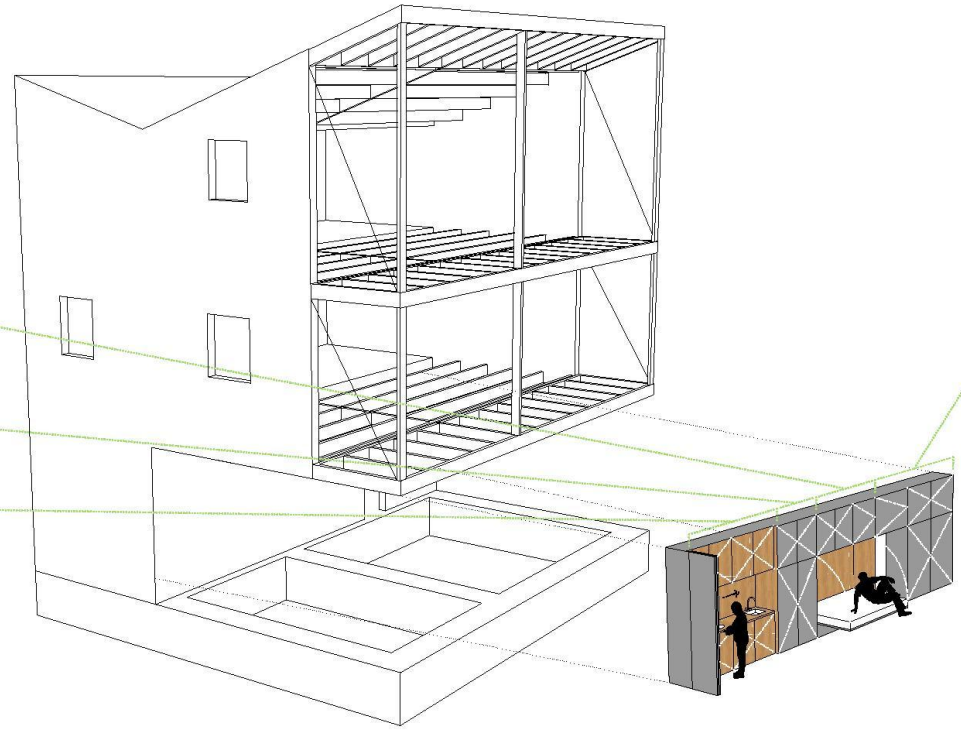
rowhouse layers- summer kitchen/ multipurpose storage/ garden tools storage



folding bed
-flexible and moving element
-easy folding/ unfolding
-maximizes use of groundfloor deck

additional storage
-used by personal temporary needs
-can be used for storing deck chairs

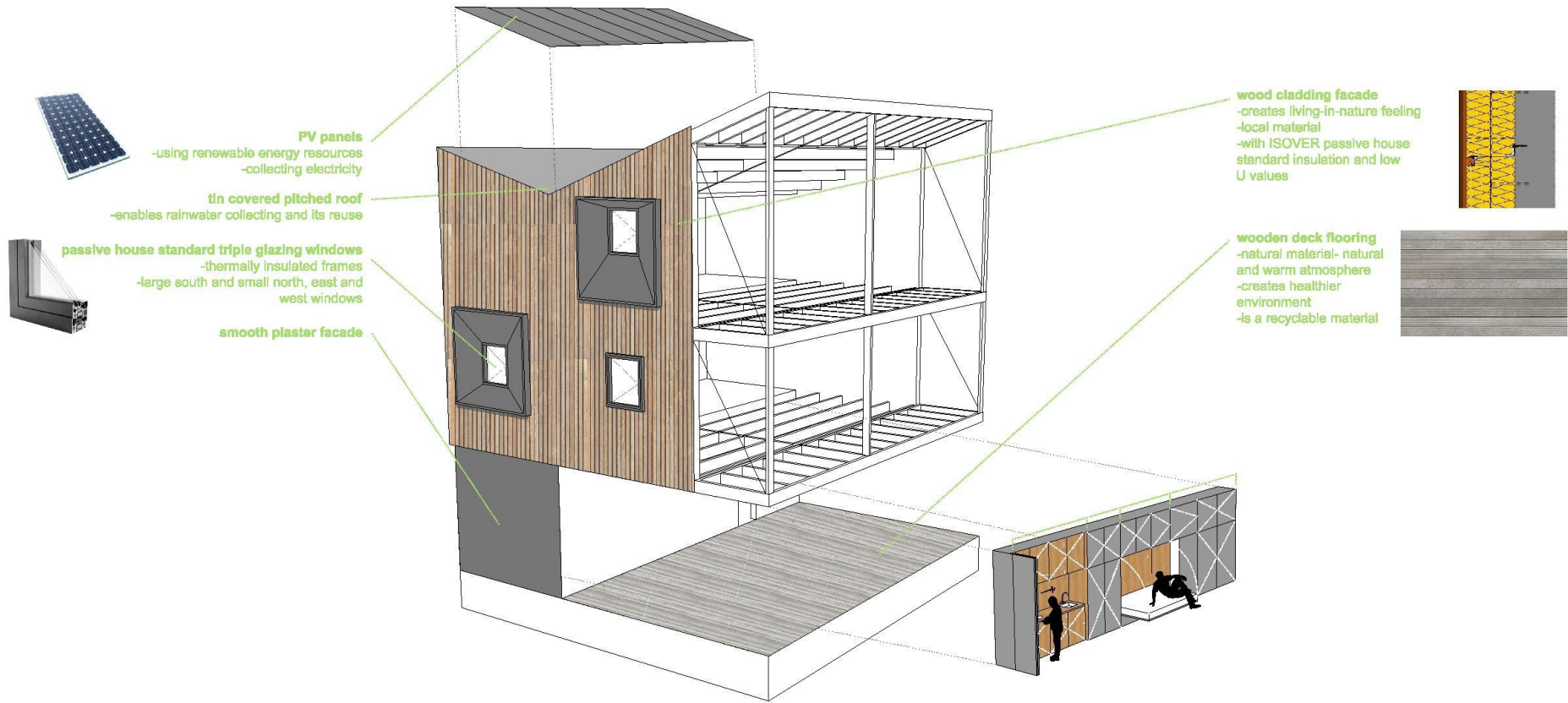
summer kitchen
-used for outdoor cooking
-maximizes use of groundfloor deck
-enables spending more time in nature



garden tools storage
-for storing tools used in own urban gardens:
shovel, fork, rakes, hose, axe, lawnmower...
-promotes growing own plants and organic food



rowhouse layers- facade and roof PV panels



rowhouse layers- multi- benefit buffer space



passive house standard triple glazing sliding doors
-thermally insulated frames
-internal and external facade

multi- benefit buffer space
-enables natural ventilation
-enables temperature regulation
-protects from overheating
-protects from external noise



external sun protection
-prevents interior overheating
-protect from direct sun rays



rowhouse possible scenarios



residents: couple



residents: parents
2 children



residents: grandparents + parents
2 children



residents: grandparents
parents



residents: parents
4 children

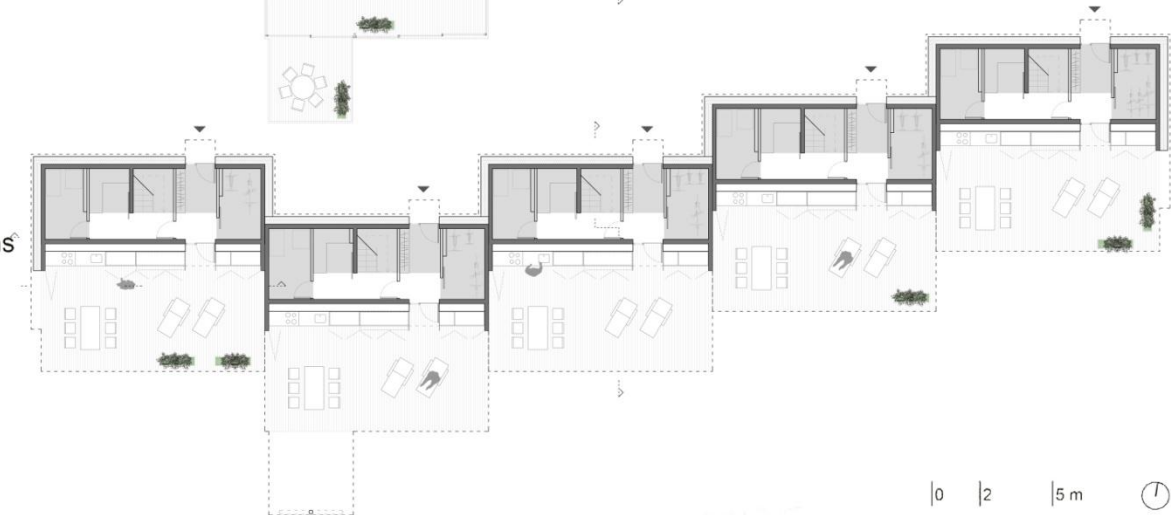
2nd floor (+6,00) floorplans



1st floor (+3,00) floorplans



groundfloor (±0,00) floorplans



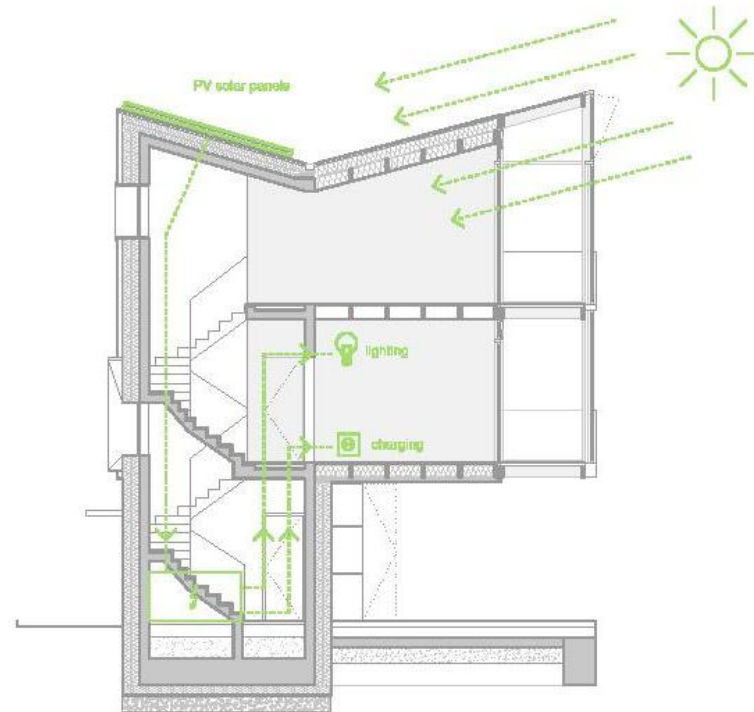
possible scenarios- cross sections



possible scenarios- rowhouse north and south facades



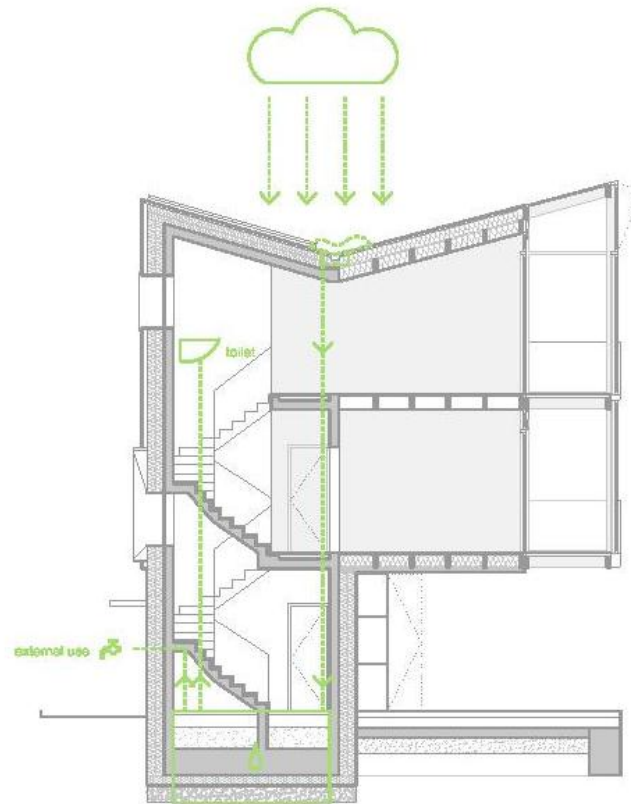
passive energy and sustainability diagrams- **benefits**



PV panels, roof shape and daylight

- PV panels placed on the northern roof slope enable the most efficient collection of solar energy which is stored in accumulators at the ground floor
- big openings and roof shape on south facade (15°) enable penetration of daylight in all rooms in the house

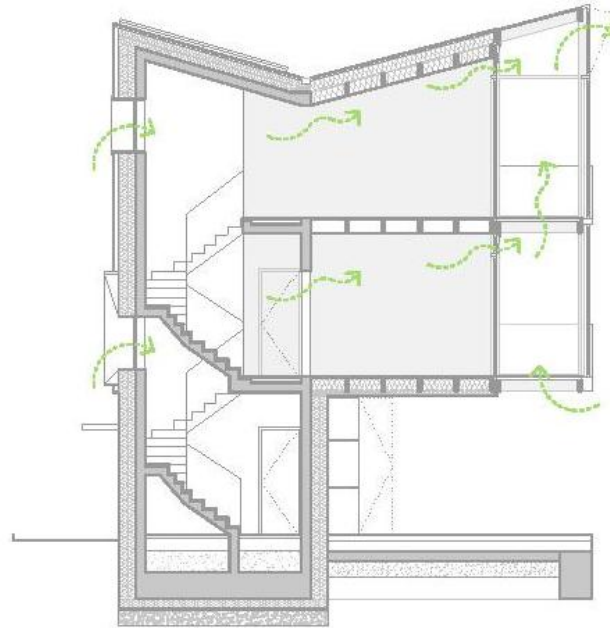
passive energy and sustainability diagrams- **benefits**



rainwater collection

- roof shape enables maximum efficiency of rainwater collection
- water is filtered and stored in the underground tank
- collected water is used as sanitary water and for external use

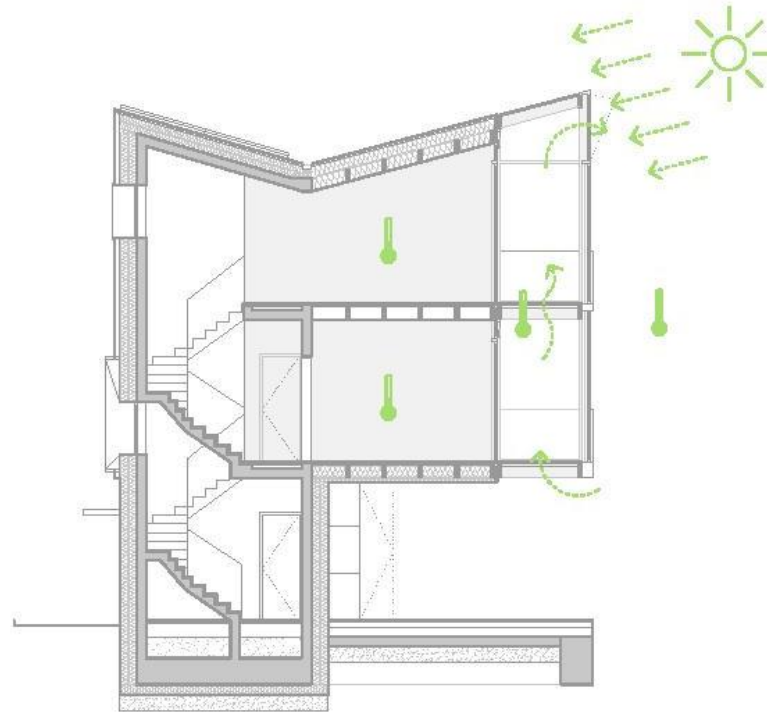
passive energy and sustainability diagrams- **benefits**



natural ventilation

- efficient natural ventilation is enabled by placement of the windows on two opposite sides of the house
- the interspace can be naturally ventilated through openings on the bottom and the top of the construction

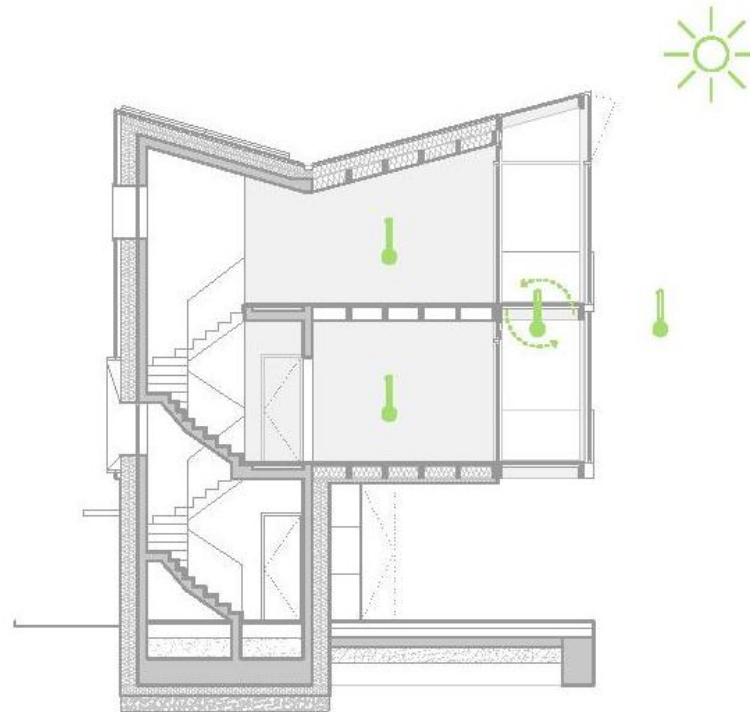
passive energy and sustainability diagrams- **protection**



temperature regulation

-during hot days interior facade is closed but interspace is ventilated which prevents house interior from overheating

passive energy and sustainability diagrams- protection

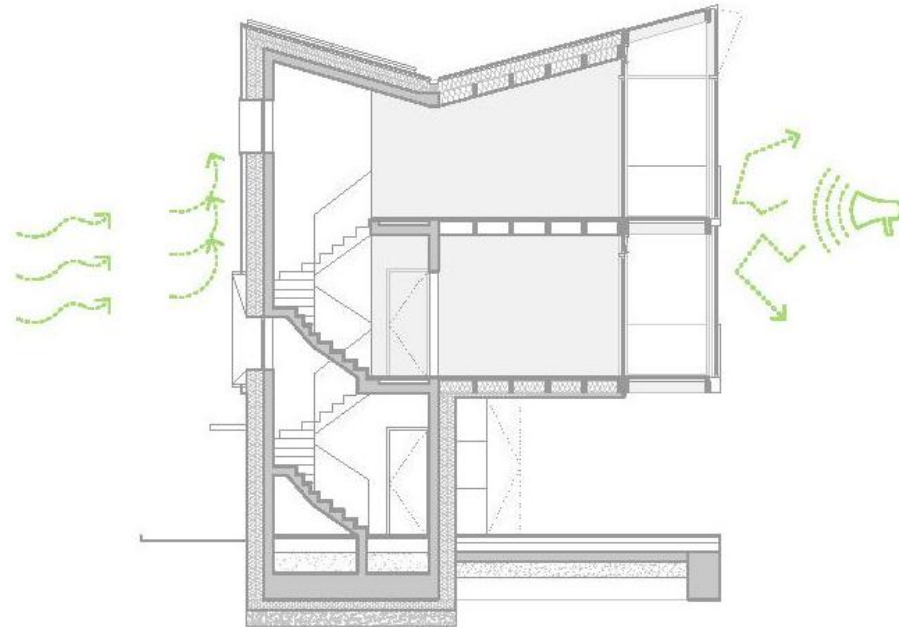


temperature regulation

-during cold days interspace is closed so air in interspace is warmer than outside air

-inside space can be naturally ventilated with warmer air through the interspace

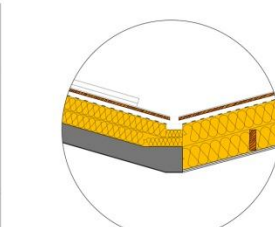
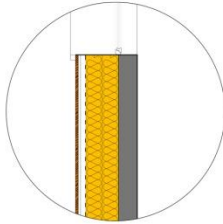
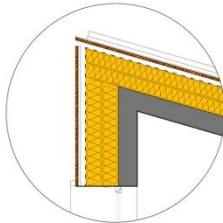
passive energy and sustainability diagrams- protection



wind and noise protection

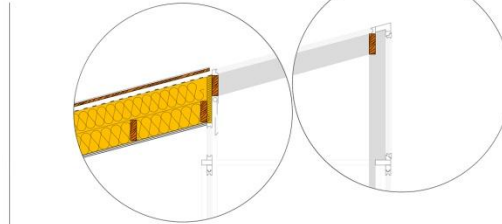
- loadbearing northern walls protect the inside from cool winds
- interspace on south protects the inside from outside noise

rowhouse- construction details



R1- pitched roof, concrete construction
 interior plaster 0,5 cm
 concrete roof slab 18 cm
 water vapour barrier- ISOVER VARIO KM duplex 0,1 cm
 ISOVER lightweight glass wool board between battens 16 cm
 ISOVER lightweight glass wool board between counter battens + water vapour permeable wind protection layer 12 cm
 ventilated air space between battens 5 cm
 under roof- impregnated OSB formwork 2,4 cm
 underlay 0,5 cm
 tin roof covering connected by standing seam 0,05 cm
 solar panels -

U= 0,11 W/m²K



R2- pitched roof, timber construction
 gypsum plasterboard, 2-layered 2,5 cm
 water vapour barrier-ISOVER VARIO KM duplex 0,1 cm
 ISOVER lightweight glass wool board between battens 24 cm
 ISOVER lightweight glass wool board between battens (B20) 22 cm
 water vapour permeable wind protection layer -
 ventilated air space between battens 5 cm
 under roof- impregnated OSB formwork 2,4 cm
 underlay 0,5 cm
 tin roof covering connected by standing seam 0,05 cm

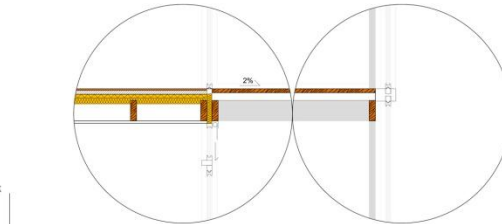
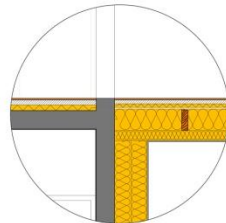
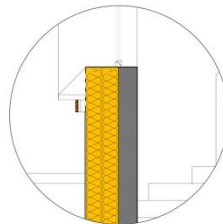
U= 0,10 W/m²K

DW1- outer wall, concrete construction
 interior plaster 0,5 cm
 reinforced recycled concrete wall 18 cm
 ISOVER facade insulation board + plug anchor 16 cm
 ISOVER facade insulation board + plug anchor 16 cm
 + water vapour permeable wind protection layer 5 cm
 ventilated air space 2,4 cm
 facade substructure 2,4 cm
 facade timber boarding 2,4 cm

U= 0,10 W/m²K

MK3- floor above air
 parquet 1,5 cm
 cement screed 5 cm
 vapour barrier 0,02 cm
 ISOVER impact sound insulation board 55 2,5 cm
 OSB formwork 2,5 cm
 water vapour barrier- ISOVER VARIO KM duplex 0,1 cm
 ISOVER lightweight glass wool board between rafters 24 cm
 ISOVER lightweight glass wool board between battens (B20) 22 cm
 facade reinforcement layer 0,3 cm
 facade finish coat 0,2 cm

U= 0,10 W/m²K

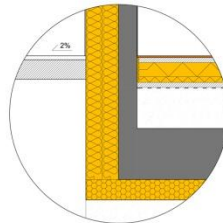


DW2- outer wall, concrete construction
 interior plaster 0,5 cm
 reinforced recycled concrete wall 18 cm
 ISOVER facade insulation board + plug anchor 16 cm
 ISOVER facade insulation board + plug anchor 16 cm
 facade reinforcement layer 0,3 cm
 facade finish coat 0,2 cm

U= 0,12 W/m²K

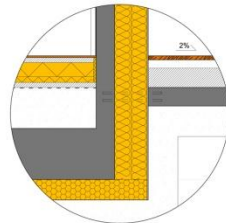
DW2- outer wall, concrete construction
 interior plaster 0,5 cm
 reinforced recycled concrete wall 18 cm
 ISOVER facade insulation board + plug anchor 16 cm
 ISOVER facade insulation board + plug anchor 16 cm
 facade reinforcement layer 0,3 cm
 facade finish coat 0,2 cm

U= 0,12 W/m²K



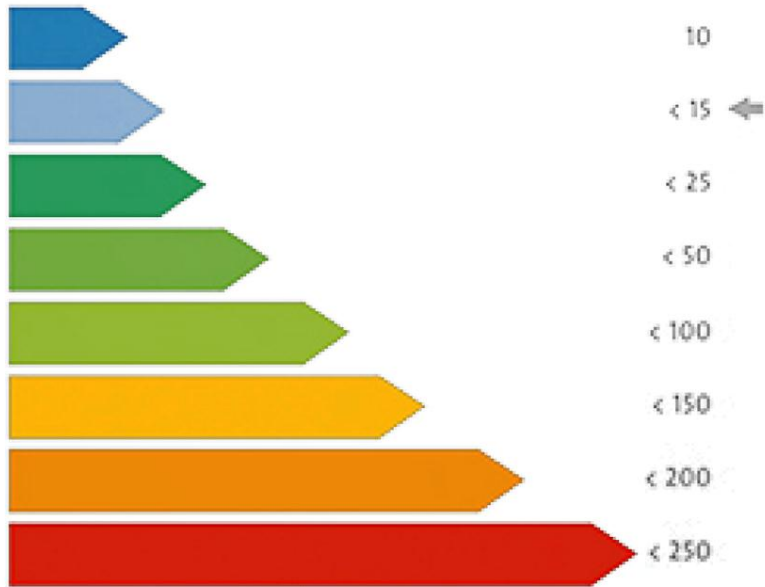
F1-floor above ground
 parquet 1,5 cm
 cement screed 5 cm
 vapour barrier 0,02 cm
 ISOVER EPS-W 20 14 cm
 ISOVER impact sound insulation board 55 5,5 cm
 protective concrete 4 cm
 water barrier- separating layer 0,5 cm
 round gravel 40 cm
 foundation concrete slab 50 cm
 ISOVER XPS foam board 18 cm
 round gravel 15 cm
 earth -

U= 0,10 W/m²K



F2- wooden deck
 wooden deck with holes for water drainage (min. 4 mm) 2,5 cm
 floor substructure- waterproof timber (4x5 cm) 5 cm
 variable height supports + ventilated air space 4 cm
 sub- concrete with an incline 2% 8 cm
 round gravel 15 cm
 earth -

rowhouse- energy demand calculations



Energy efficiency classes

Heat Demand Calculations

Transmission Heat Losses:	4534.44 kWh/a
Ventilation Heat Losses:	870.41 kWh/a
Total Heat Losses:	5404.86 kWh/a
Internal Heat Gains:	1397.57 kWh/a
Available Solar Heat Gains:	2556.53 kWh/a
Total Heat Gains:	3721.98 kWh/a
Annual Heat Demand:	1882.88 kWh/a
Specific Annual Heat Demand:	12.80 kWh/(m ² a)

rowhouse- interior 3d



rowhouse- summer exterior 3d- south facade



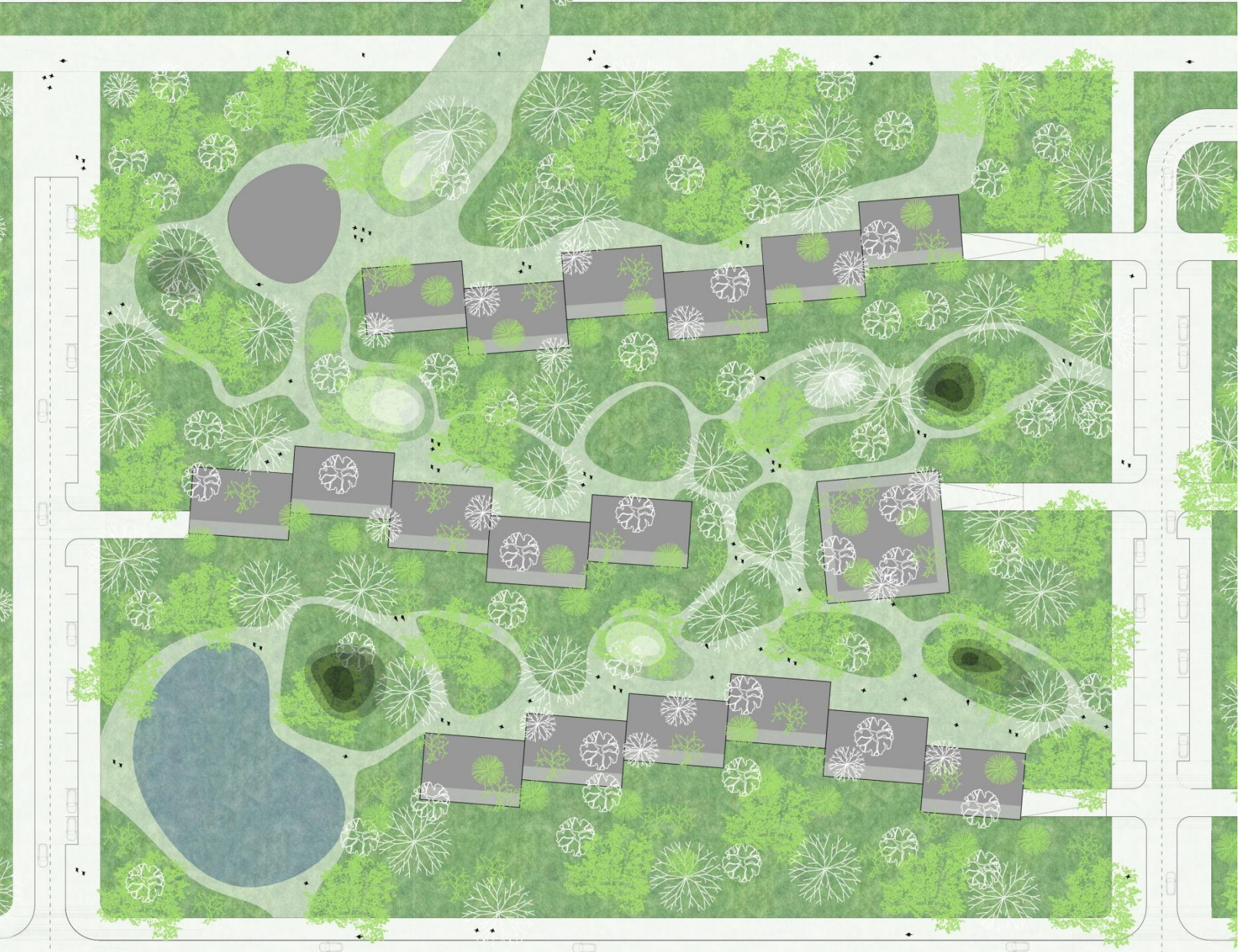
rowhouse- winter exterior 3d- south facade



rowhouse- autumn exterior 3d- north facade



general block masterplan- residential building block rooftop plans



residential building- plans

residential building segment typical cross section



residential building segment typical floorplan

0 | 2 | 6 m



residential building segment typical facade



residential building- summer exterior 3d- south facade



thank you for your attention!