



Source list

Important info

Everlasting Horizon

No Footprint House - Costa Rica

This is what we include in our design:



source 1

Passive climate control techniques

natural ventilation and shading
wooden slats on east and west facade
HR++ glass

Materials

exterior wood finish

Connecting local water and energy supplies

powered by renewable energy (solar panels or water pump)

Concrete foundation

with durable construction such as steel or timber frame construction

Our target group



Small households
for **1 to 2 people**
between age **20**
and **40**

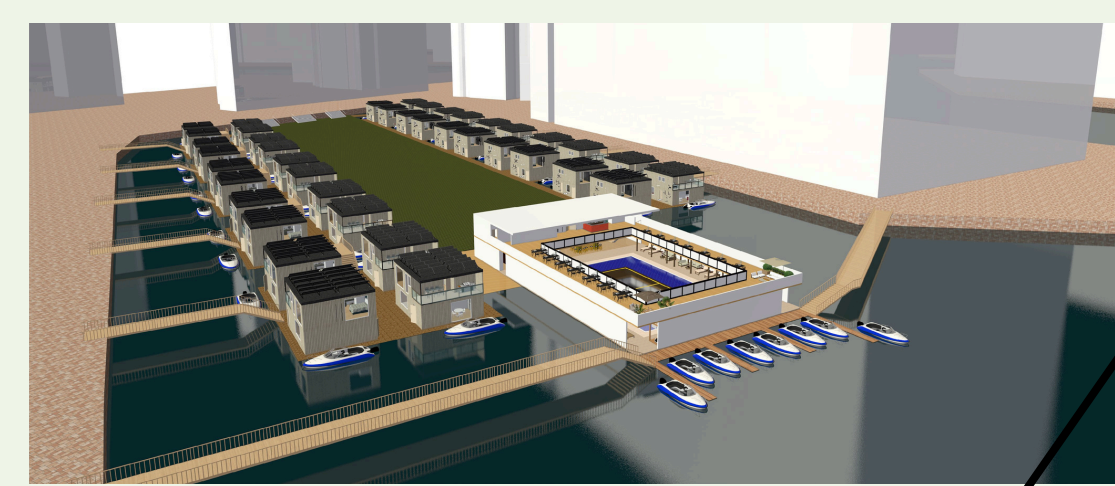
Location



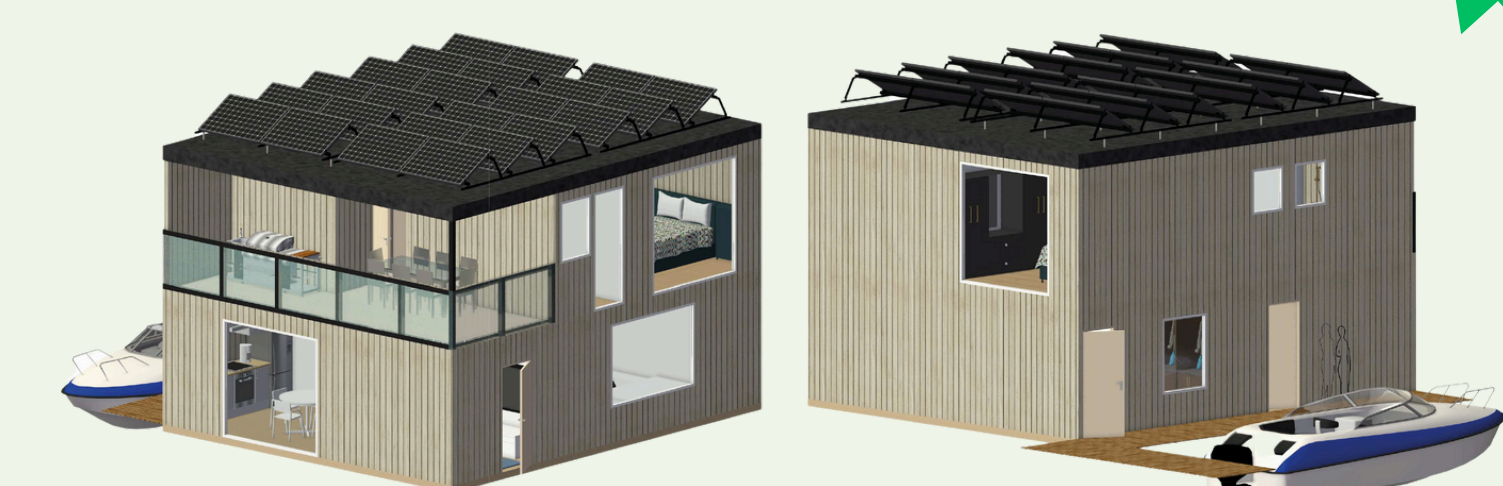
MH4
Gustoweg 1
3029 AS Rotterdam

source 2

Our design + facilities

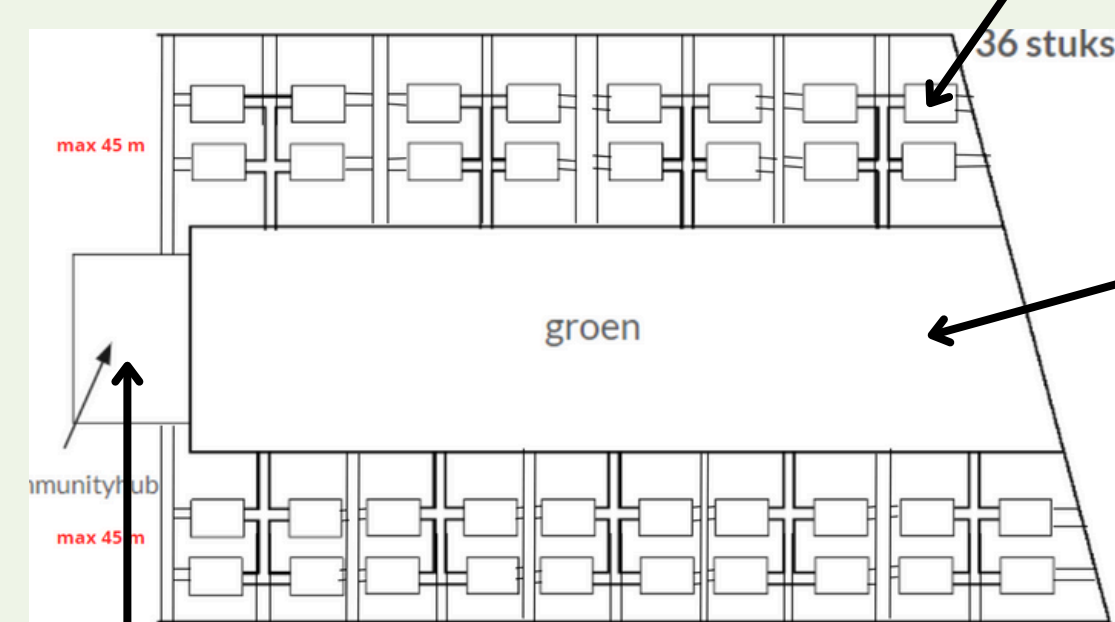


36 houses

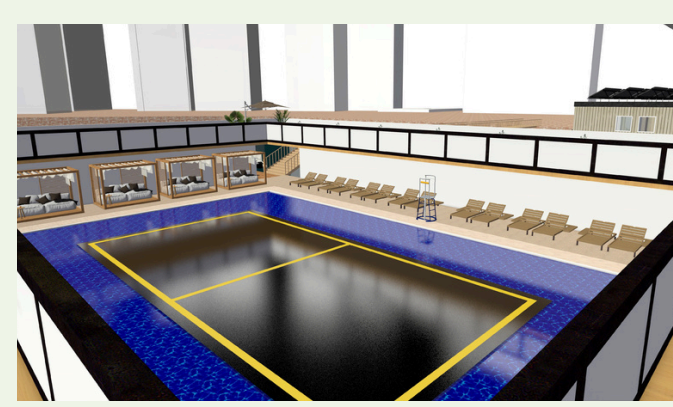
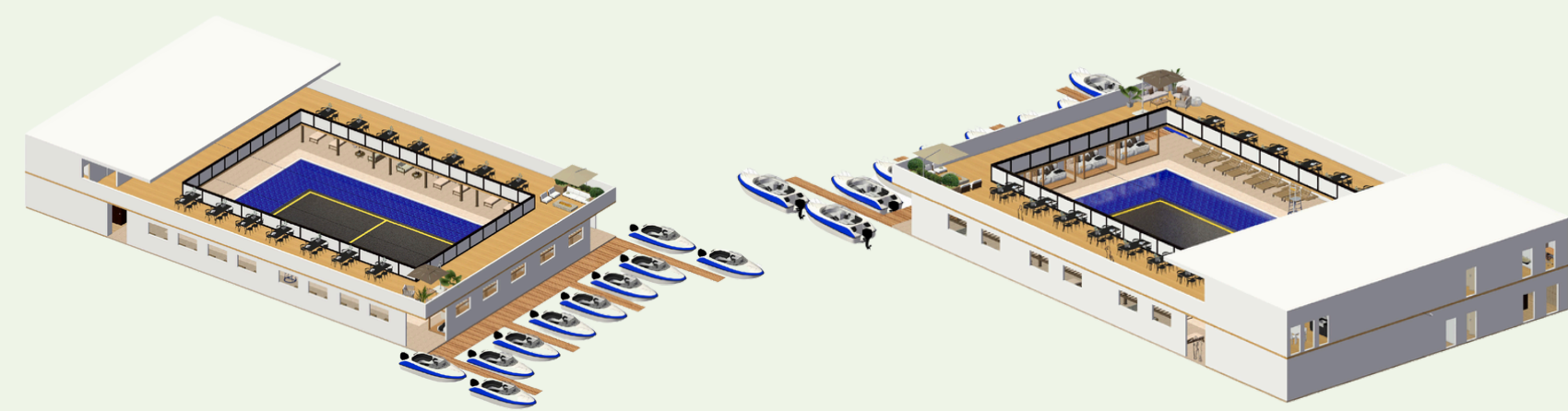


design & requirements
are in relation with each other

1 green space



1 community hub with recreation facility



4 E's in M4H inspired by NFH

EQUITY



Our chosen **target group and design** takes equality into account:

- The 20- to 40-year-old target group allows us to give young people housing as well (which is currently in short supply).
- The surrounding area has other target groups, so the other target groups also have a chance for housing in the area.
- The houses are all equally small and compact. We try to keep the price of housing as low as possible so that people with various incomes all get a chance.

ECONOMY



We try to keep the price as low as possible **without affecting the environment** because:

- We keep the energy requirements within the house as low as possible by: applying wooden slats for the windows and HR++ glass and high-efficiency installations.
- Keeping construction time short: same houses 36x and we only work with straight shapes and we work with recognisable materials (wood and concrete).
- Wooden materials, which can be found locally and therefore have low transport costs.

ENGINEER



To **reduce energy requirements** through **technology** in M4H:

- The wooden slats are also used for the windows in M4H. A high-efficiency installation is used for ventilation: the heat recovery pump can achieve an efficiency of 95%.
- To make the best possible use of the sun's heat, a parametric study is carried out using a new technology: Rhino / Grasshopper. The M4H construction is also applied with concrete and a light construction on top: timber frame construction.

ENVIRONMENT



We consider something sustainable if it uses **renewable energy** and **if it lasts a long time**:

- There will be a green roof on each house and green provision.
- Renewable energy installations: solar panels and water pump. And high-efficiency installations: heat recovery installation.
- Natural materials: wood and insulation material cork with low shadow costs.
- We build 36 houses and a community hub that can last for more than 50 years.

EQUITY

This design can cater for any target group: single-storey design and costs are low because minimal installations have been used.

ECONOMY

Local products used: wood, therefore low transport costs. Low costs for energy installations, by using as much renewable energy as possible: solar panels and natural ventilation.

ENGINEER

They have used wooden slats here for natural ventilation, so no installation is required for ventilation. The construction is made of steel, making large spans possible. The foundation is made of concrete, so the house is above the ground.

ENVIRONMENT

Here they used natural ventilation, solar panels and wood. They have used as few materials and energy from renewable sources as possible: sun.



Schedule of requirements

ZONING PLAN

- Make use of environmentally friendly materials: wood and cork
- The project encourages the use of circular products: cork insulation and wood
- Additional focus on energy transition: use of solar panels and water pump
- The district should combine living, working, education and various amenities: we combine living, recreation and green amenities
- There should be 2-3 thousand houses in the district, for our design at least 30 houses
- There should be a central meeting place in the 'larger' neighbourhoods: at least 1 community hub
- There should be a focus on the neighbourhood's past: port area and industrial look (wood and steel for example)
- Good connections between neighbourhood residential areas: maximum path of 30 metres to reach your home
- There should be sufficient green space in the district: minimum green space of 25 by 20 metres

AESTHETICS MEMORANDUM:

- All new buildings have a simple and clear main rectangular form, around 7.5 by 9 metres
- Low on architecture, the architecture is derived from the function and the main form. These should be subdued. (Definition subdued: quiet and restrained).
- Low on colour: when designing the building, the aim is to use subdued colours. Light colours are used, greys, silver or white with small colour accents if necessary.
- Cabinets with additional facilities will be combined into a structure as much as possible. This structure has a simple main form: rectangular
- An advertising plan is required for buildings with multiple users.
- Expressions and logos should be elaborate, with good graphic quality and matching the architecture of the object.
- Company announcements (naming) should preferably be placed just above the cornice instead of being painted or stuck to the façade; it is not about advertising but about identifying the company.

BUILDING WORKS DECREE LIVING ENVIRONMENT (bbi):

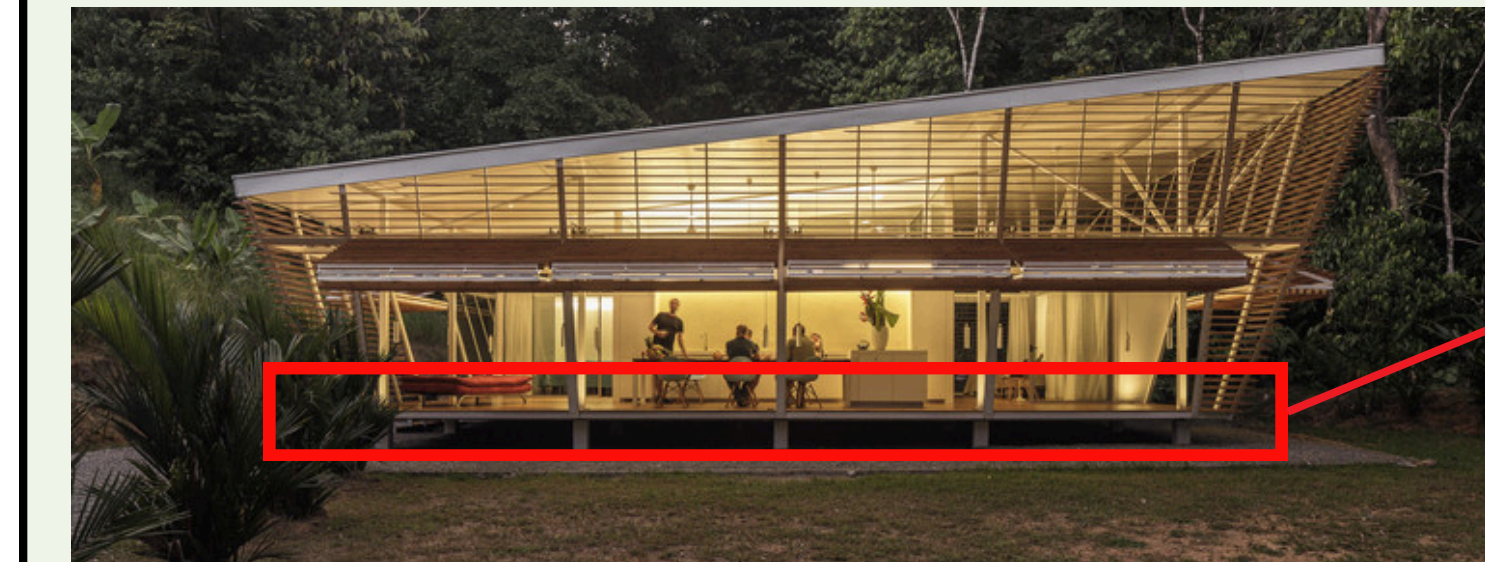
- A residential function has a minimum floor area of 18 m² of habitable area.
- At least 55% of the usable area of a residential function is a domestic area.
- A domestic area has a floor area of at least 5 m².
- A domestic area and a domestic space have a width of at least 1.8 m.
- At least one domestic area has a floor area of 11 m² with a width of 3 m.
- A domestic area and a domestic space shall have a minimum clear height of 2.6 m.
- The number of bathroom space in a dwelling is at least 1 piece.
- A bathing area without a toilet has a minimum floor area of 1.6 m² and a minimum width of 0.8 m.
- A bath room has a minimum clear height of 2.3 m.
- Within a residential function, there is at least 1 toilet which can be used.
- The minimum floor area of a toilet room is 0.9 m by 1.2 m.
- A toilet room has a minimum clear height of 2.3 m.
- The landing and corridor (traffic routes) have a minimum clear width of 0.85 m and a clear height of 2.3 m.
- Interior doors have a minimum clear width of 0.85 m and a clear height of 2.3 m
- A residential function has a non-common outdoor space with a floor area of at least 4m² and a width of at least 1.5 m.

	Count	Functional useful floor area m ²	Total functional useful floor area m ²
First floor			
Keuken met eethoek	1	18,75	18,75
Kantoor	1	8,5	8,5
Tech. Ruimte	1	4,5	4,5
Een wc	1	1,3	1,3
Kleine garage voor fietsen e.d	1	3,45	3,45
Berging	1	4	4
Second floor			
Kleine slaapkamer	1	11,4	11,4
Grote slaapkamer	1	14	14
Een badkamer met wc	1	6,25	6,25
Een balkon	1	18,4	18,4
Total m ² FNO			90,55
Bruterij installatie, constructie en wanden	25%		
Total m ² BVO			113,1875

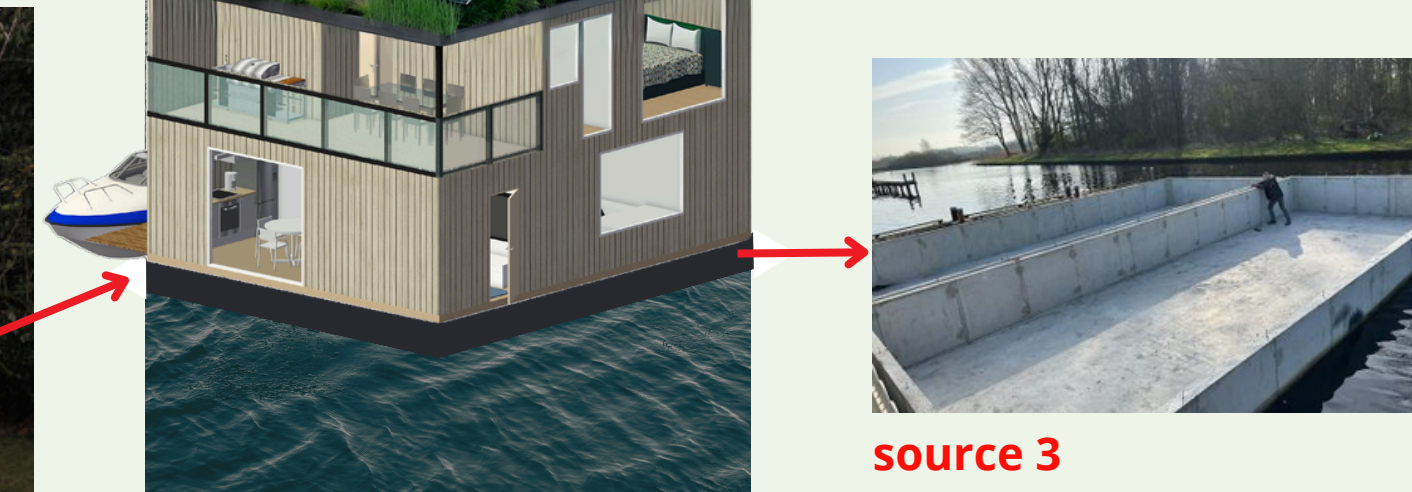
- A domestic area has an equivalent daylight area in m² -whose numerical value is not smaller than 10% of the floor area in m² of that domestic area.
- A domestic area has an equivalent daylight area determined in accordance with NEN 2057 that is not smaller than 0.5 m². When a residence area of a dwelling is 30 m², an equivalent daylight area of at least 3 m² must be present.
- When determining an equivalent daylight area as referred to in the first and second paragraphs: a. building structures and similar obstructions located on a different plot shall not be taken into account; b. daylight openings in an external partition construction, which are measured perpendicular to the projection plane of those openings at a distance of distance of less than 2 m from the plot boundary shall be disregarded, whereby, if the plot on which the user function is located borders on a public road, public water or public green space, the distance shall be kept to the centre of the road, public green space or public greenery or public water, and c. the angle of obstruction a referred to in NEN 2057 to be taken into account for each segment to be distinguished is not less than 20°.

Minimum RC value skin:
- Façade: 4.7 m²/K/W
- Roofs 6.3 m²/K/W
- Floors 3.7 m²/K/W

Floating community



concrete foundation with wood finish



concrete pontoon (foundation) with wood finish

source 3

Construction method

Timber frame construction



source 4

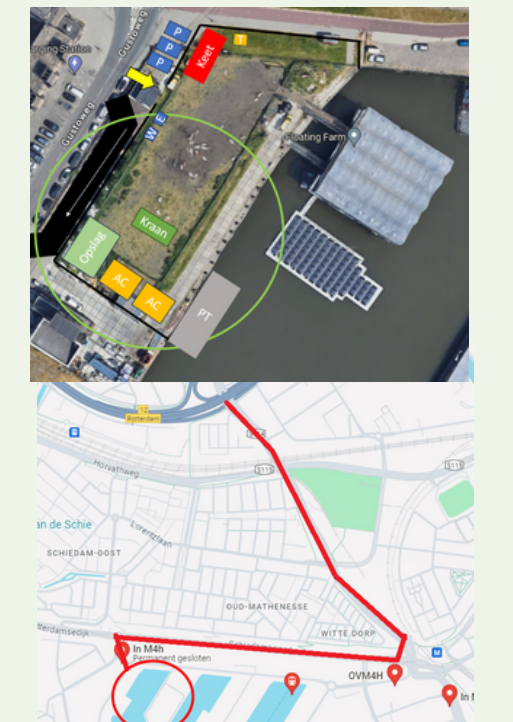
Transport, logistics

NFH transport by truck



source 5

M4H Everlasting Horizon by truck

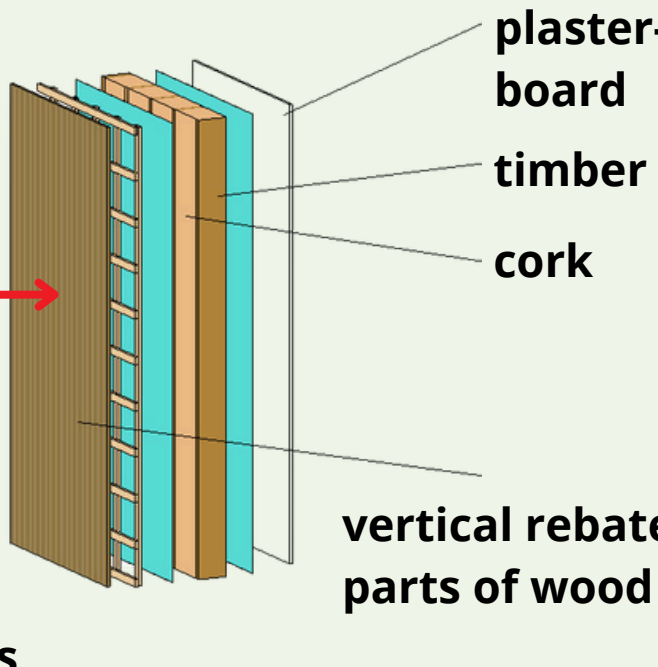


Materials



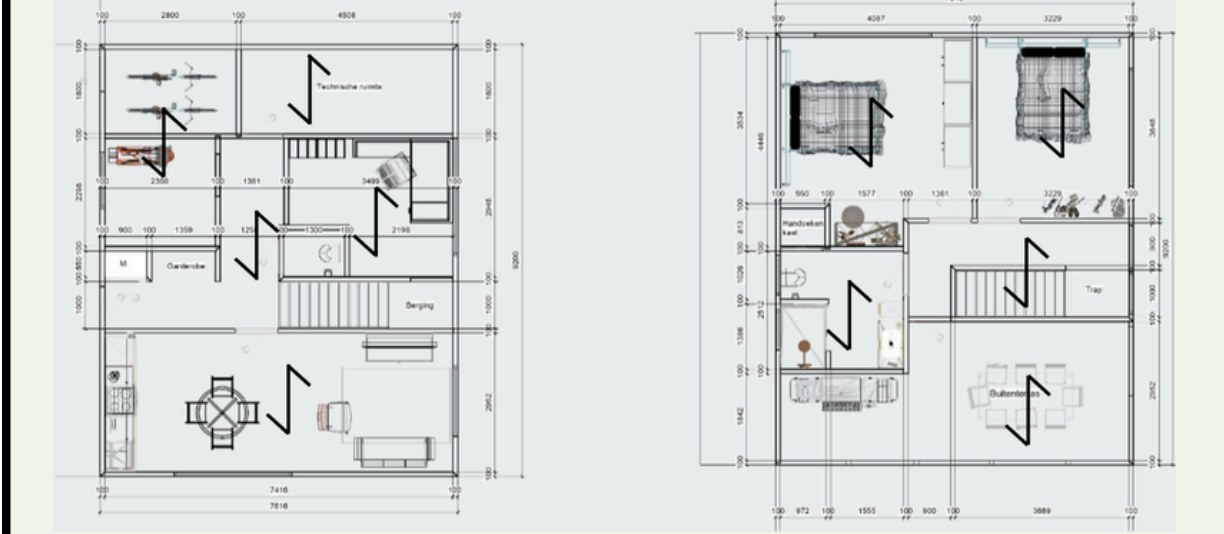
concrete Liapor

wooden slats



see next poster for specifications

Structure, build technology



Reasons to choose our design:

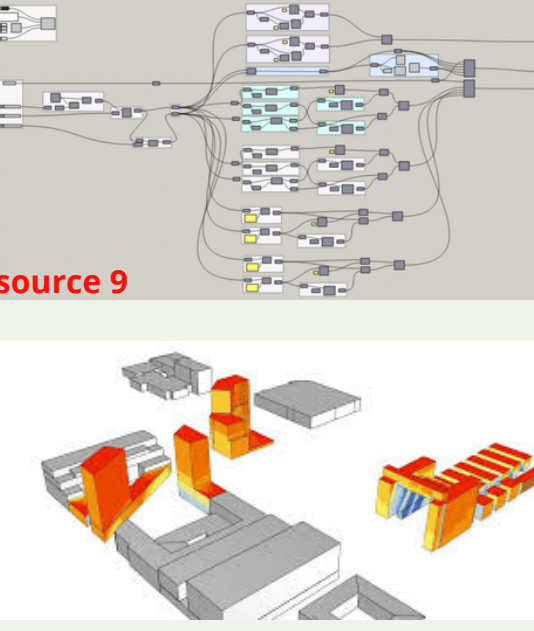
- ✓ **Scalable**
Rectangular same designs 36x making it easy to build and scale up quickly.
- ✓ **Future residents eager to move in**
The target group is 20 to 40 years old and there is a housing shortage for this. In addition, the location is in the middle of Rotterdam.
- ✓ **Environmentally friendly**
Green amenities, solar panels, water pumps and cork insulation with wood and small, compact homes.
- ✓ **Future-oriented**
The houses can last for more than 50 years and in this way, the residents enjoy living, it is sustainable and you as the client take out the cost. This benefits all stakeholders: future residents, construction company, client and municipality of rotterdam.

New technology

Design and engineering find their common ground in parametric design. Using input with data via software Rhino / Grasshopper, the optimum window position can be determined. As a result, you have placed windows making it cool in summer and warm in winter. This passive energy is inspired by the No Footprint House.



source 8



source 9

Physics

- windows on the east and west using parametric design
- escape routes in 2 directions with a maximum number of meters (see appendix)
- cork insulation fire class B2
- plasterboard fire class A1
- cork for acoustic and insulation: lambda value 0.038 - 0.040 W/mK
- solar panels, heat pump, electricity grid and district heating and heat recovery installation



source 11

source 12

source 13



Source list

Everlasting horizon

poster with more information

Image 1. Design of our floating houses with community hub, green spaces, recreation facility

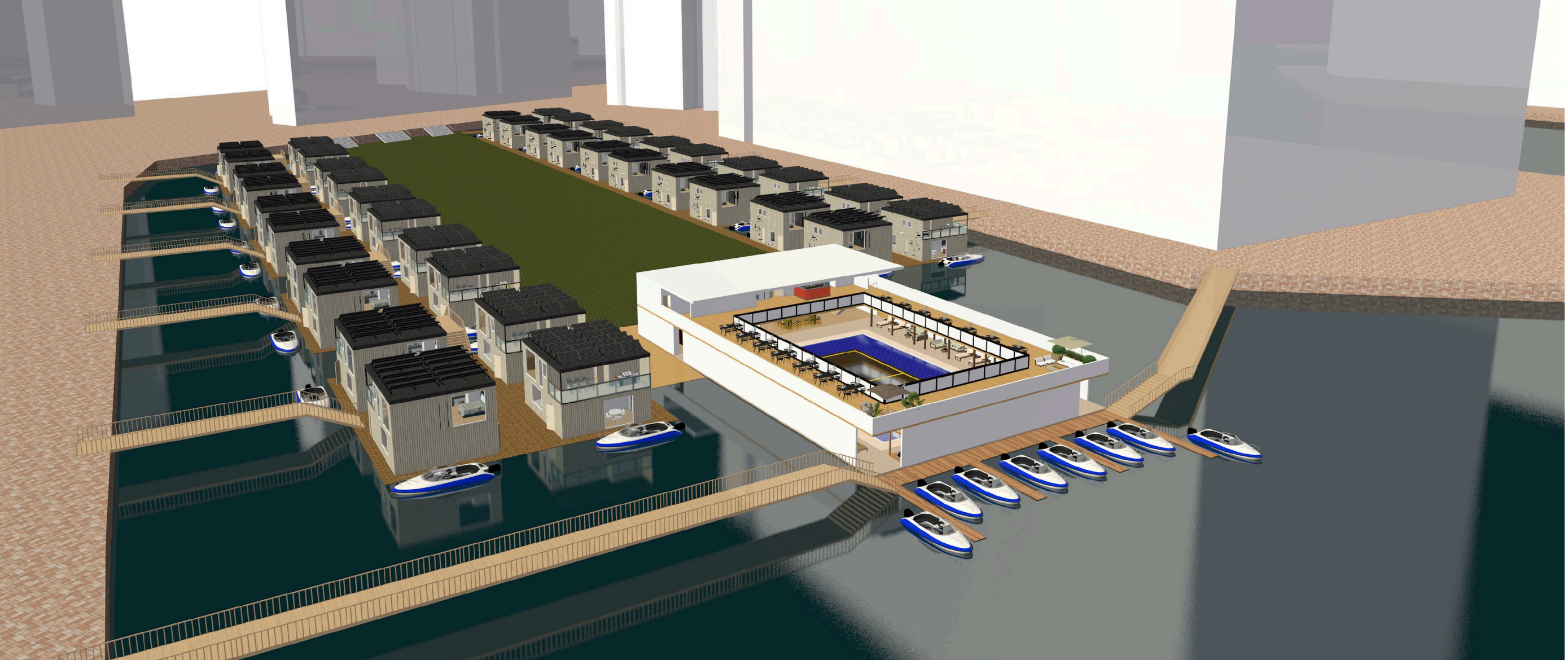


Image 2. Vision municipality of Rotterdam Merwevrehaven



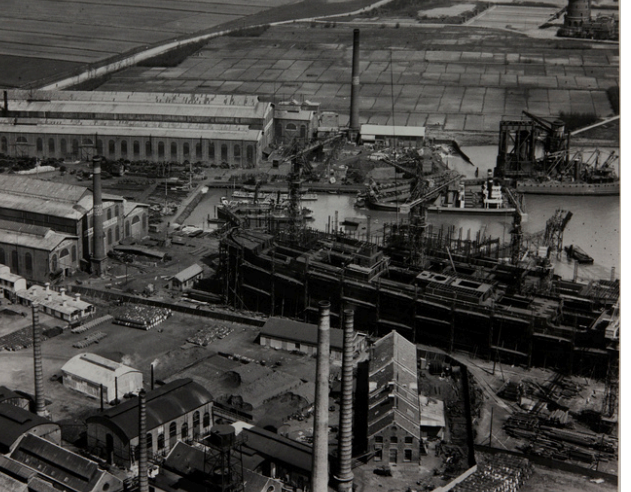
Source 1

Image 3. Vision municipality of Rotterdam Merwevrehaven



Source 2

Image 4. Area Merwevrehaven in 1922



Source 3

Image 5. No Footprint House - Costa Rica



Source 4

Target audience analysis

The "master plan"(Gemeente Rotterdam, 2023) of Merwehaven identifies several target groups that should come to the neighborhood.

These target groups are listed below:

- Small households 1 to 2 people with an age between 20 and 50.
- families
- Elderly people

Elderly

For the elderly it has been determined that there should be several elderly housing units. It has also been determined that these should be on the Marconistp. (Gemeente Rotterdam, 2023)

Small households (1 to 2 persons)

The number of small households represents a large part of the city, as much as 85% in the middle segment. The age of the residents of small households varies greatly, from 20 to 50 years old. According to the master plan (Gemeente Rotterdam, 2023) houses with 2 to 3 rooms suit this target group and also may be realized anywhere in the area.

Families

There are relatively few families living in the city, although they are very important for the city. Therefore it is important to offer them enough space in the city, for this reason they should get enough space in the area renovation of M4H, although there should be enough green spaces. According to the master plan (Gemeente Rotterdam, 2023), apartments with an elevator or ground-level housing with 3 to 4 floors will fit.

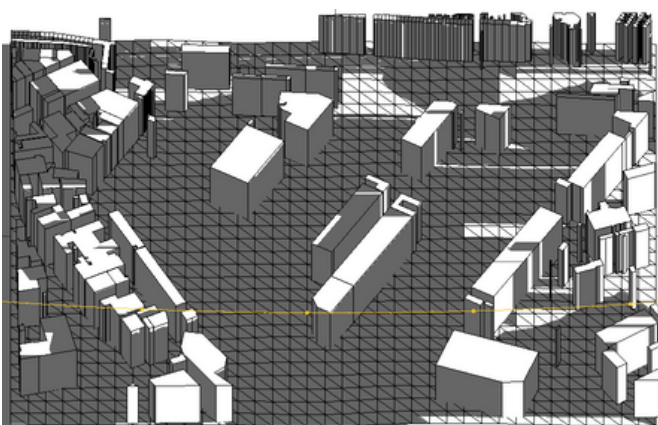
Affordable

The Master Plan (Gemeente Rotterdam, 2023) mentions that extra consideration must be given to the affordability of the housing. "In terms of price segmentation, we follow the coalition agreement, focusing on affordable housing in the social and middle segment with an emphasis on the middle segment." (Gemeente Rotterdam, 2023)

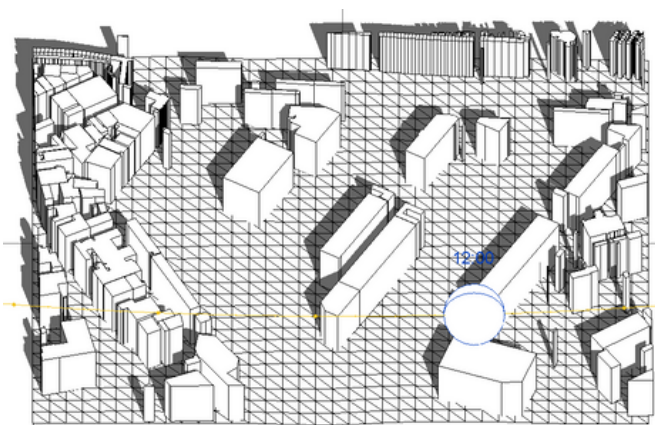
Conclusion

From all the above information we conclude that we should make housing for starters in the housing market, this includes small households for 1 to 2 people with an age between 20 and 40. This is because out of the prescribed target groups these are the best fit for a floating community and the municipality's master plan.

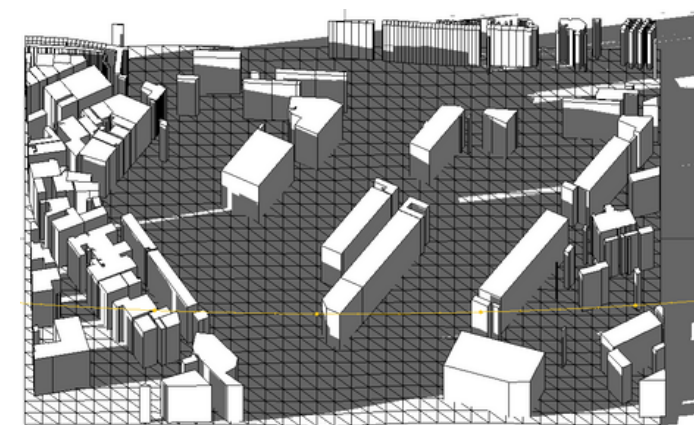
Sunlight study



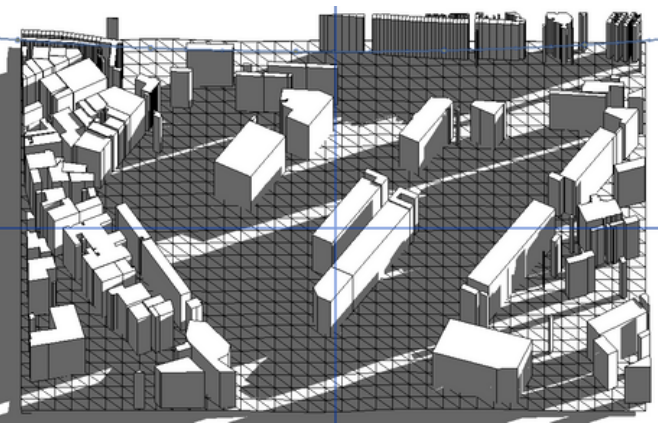
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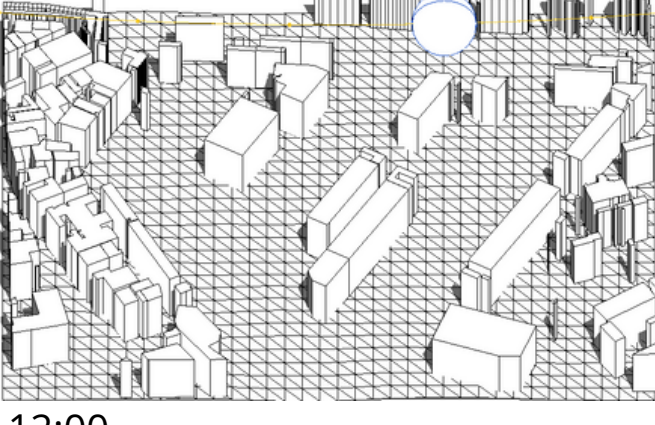
12:00



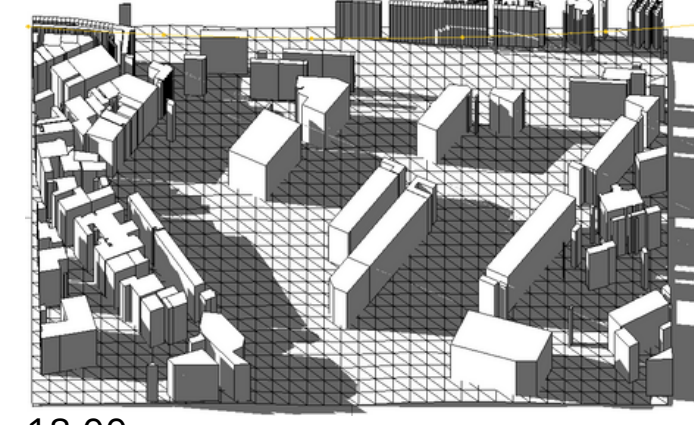
18:00



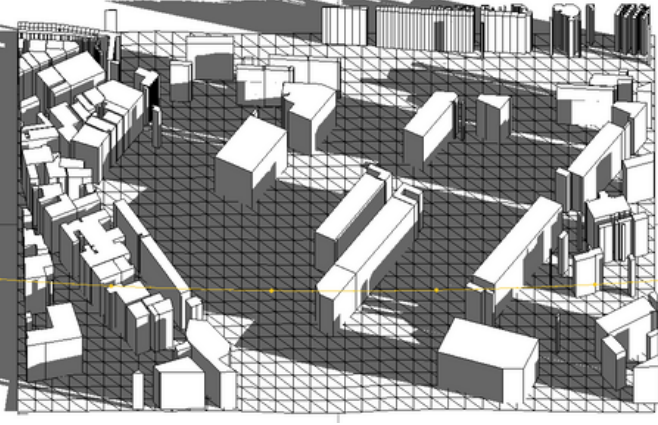
21 June 08:00



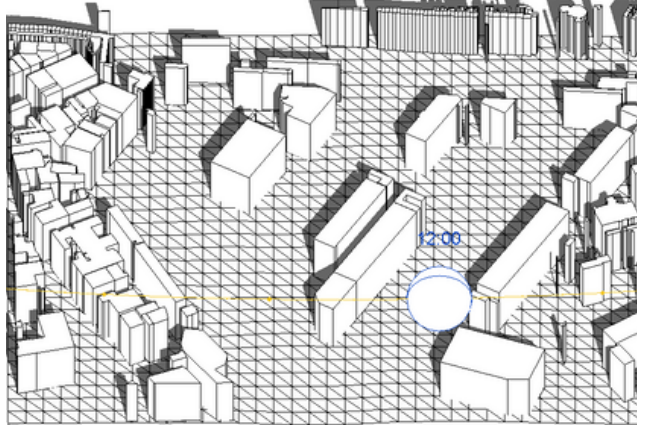
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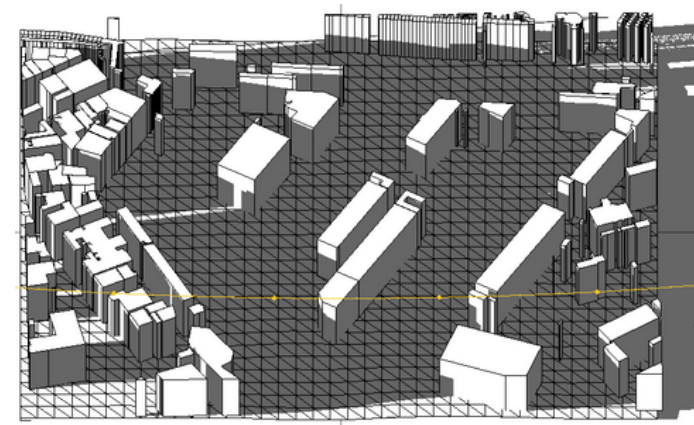
18:00



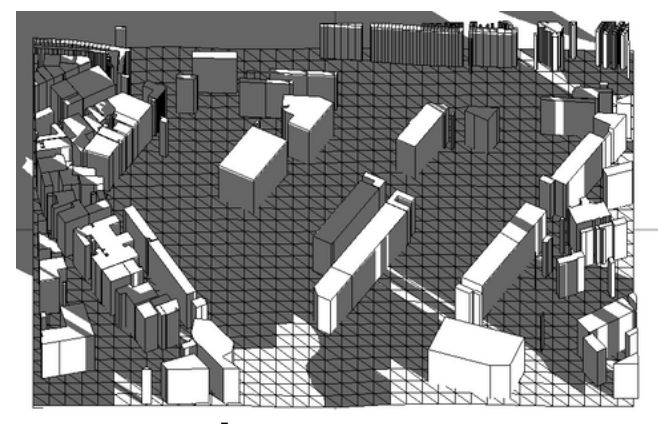
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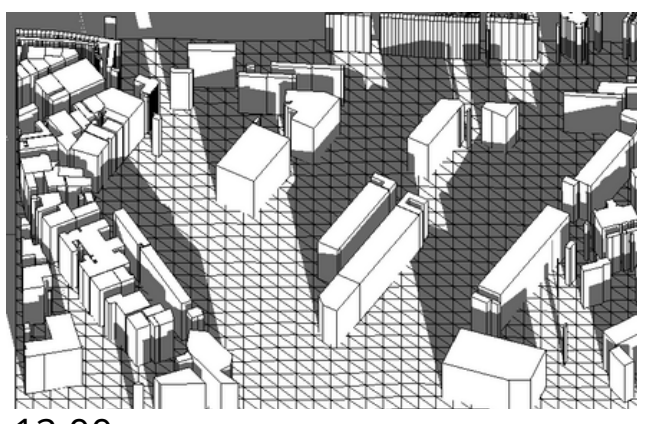
12:00



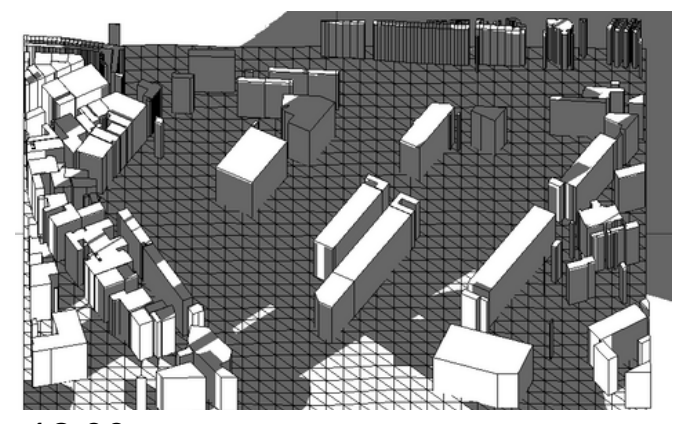
18:00



21 December 08:00



12:00



18:00

Program of Requirements

Concrete requirements from the **zoning plan**:

Sustainability:

Make use of environmentally friendly materials as quoted in the zoning plan of the municipality of Rotterdam. The project encourages the use of circular products. Additional attention should be paid to the energy transition

Functionality and program:

The district should include a combination of living, working, education and various facilities. There should be 2 to 3 thousand homes in the district

Spatial design:

There should be a central meeting place in the 'larger' neighborhoods. Good connections between the Merwehaven and the city center.

Location:

Attention should be paid to the district's past. Good connections between the residential areas of the surrounding cities.

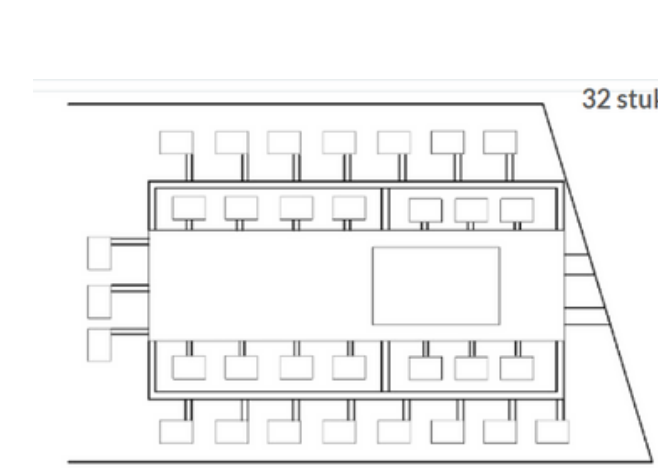
Social:

There should be enough green spaces in the neighborhood.

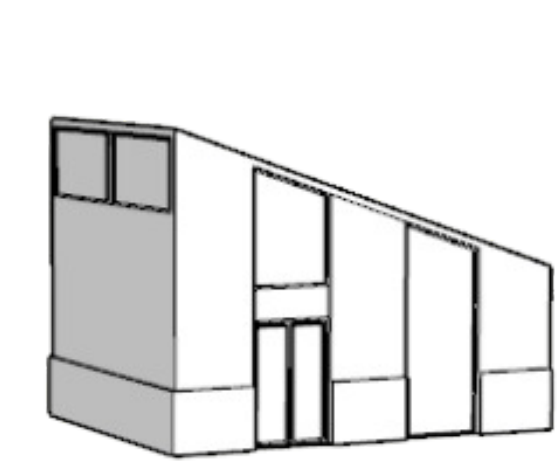
External requirements/characteristics from the welfare note:

- All new construction has a simple and clear main form.
- 'Low on architecture', the architecture is derived from the function and the main form. These should be subdued.
- 'Low on color', when designing the building the aim is to use subdued colors. Light colors are used, grays, silver or white with small color accents if necessary.
- Cabinets with additional facilities will be combined into a structure as much as possible. This structure has a simple main form.
- For buildings with multiple users, an advertising plan is required.
- Advertisements and logos shall be elaborate and of high quality, with good graphic quality and matching the architecture of the object.
- Company announcements (naming) should preferably be placed just above the cornice rather than painted or pasted on the facade; it is not about advertising but about the interpretation of the company.

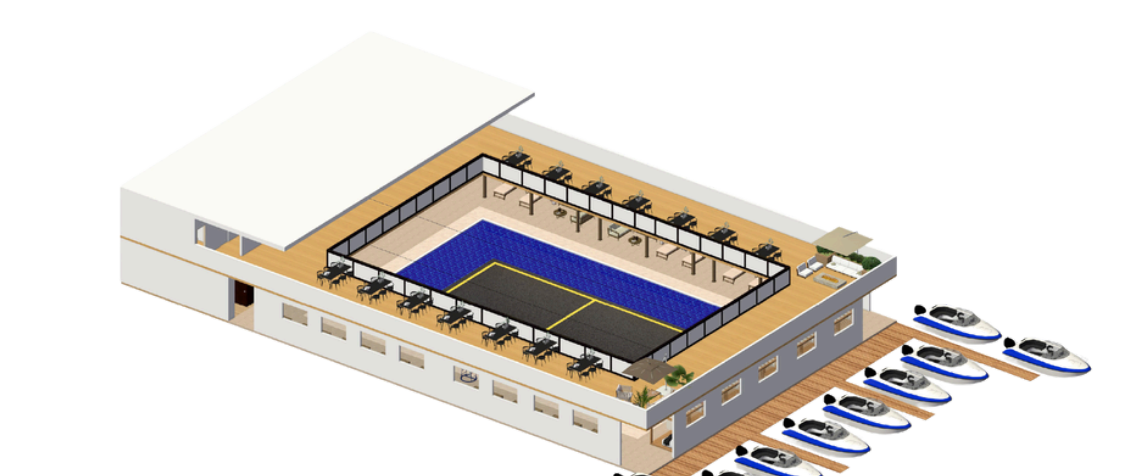
Devision



House



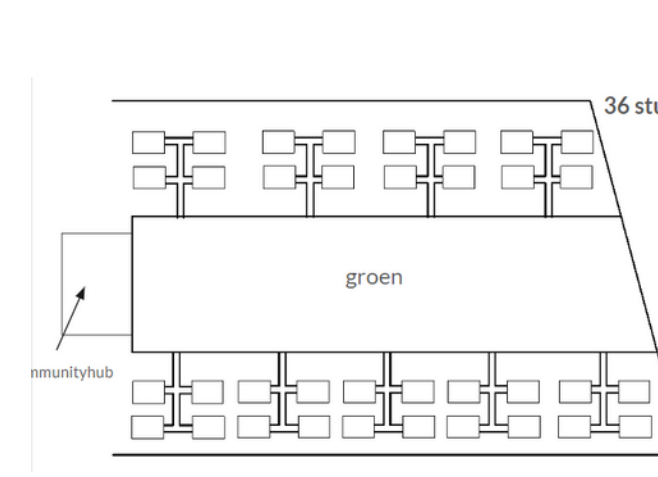
Community hub



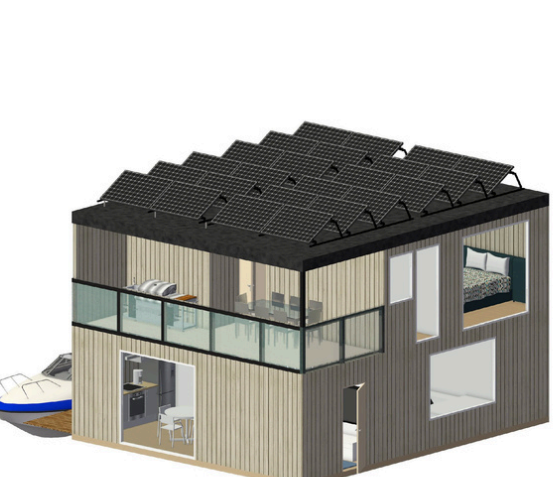
Concept 1

As you can see from the situation drawing, 32 houses have been designed, with each house standing on its own pontoon. The building has a playful character, allowing you to create ever-changing arrangements on the water, and the roof is sloping. The building consists of two floors and measures 7.5 by 9 metres. In the centre of the situation drawing is the community hub, which serves as a meeting and recreation space. The building consists of two floors and measures about 40 by 25 metres.

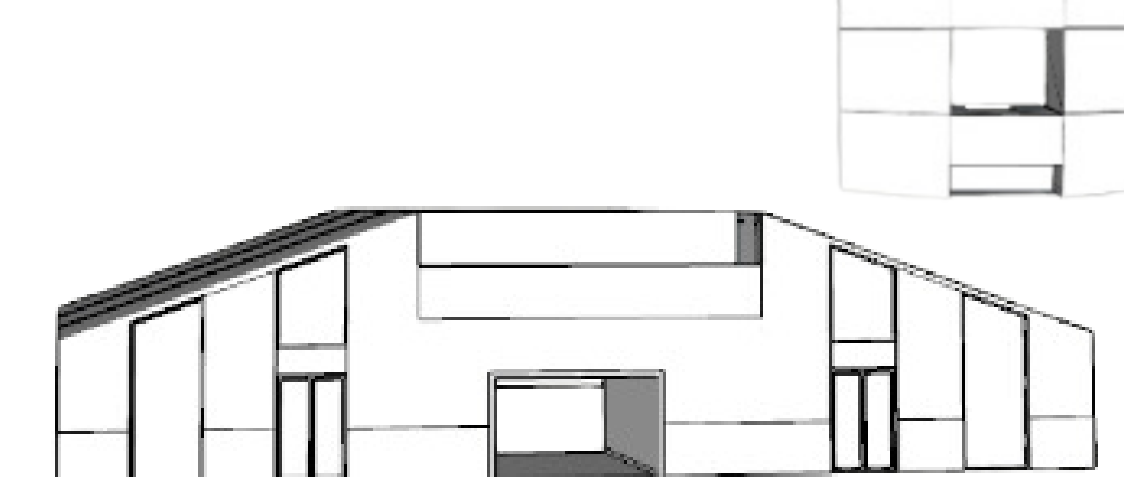
Devision



House



Community hub



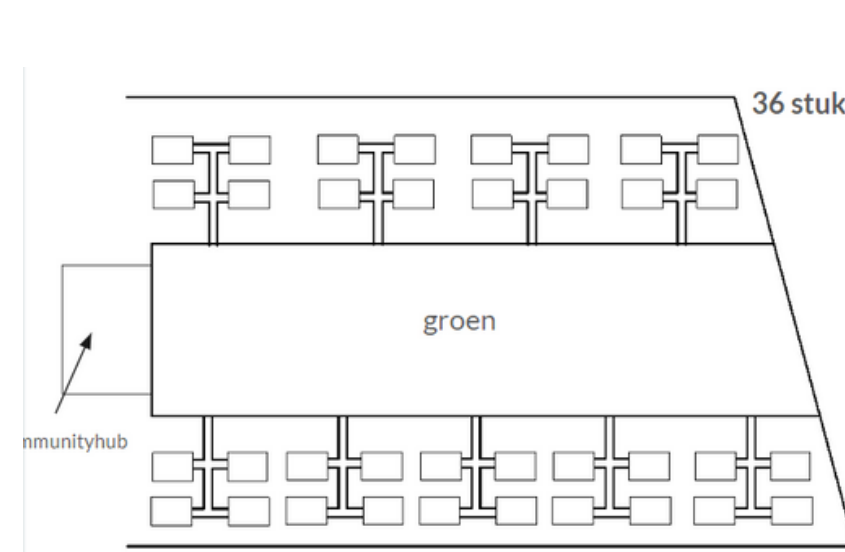
Concept 2

As you can see from the situation, 36 houses have been designed, with four houses on one pontoon. A cube-shaped building with a flat roof was designed for this design. Like concept 1, the building consists of two floors and measures 7.5 metres by 9 metres. At the centre of the situation drawing is the green space. At the far end of the situation drawing, the community hub is designed, where meeting and recreational facilities are located in the building. The community hub has a dimension of about 40 by 30 metres.

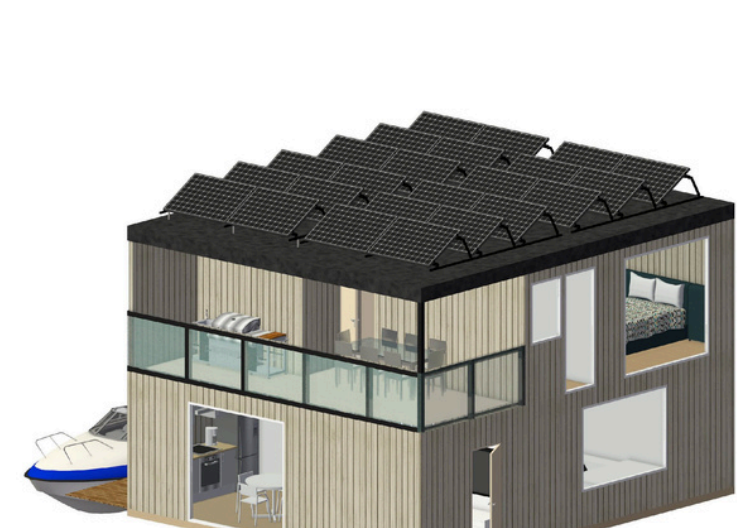
Final concept

In the end, we chose a mix of the 2 concepts. We went for the house from concept 02 and the community hub from concept 01. For the layout on the water we went for concept 02. Why we chose this can be seen in the table in the design booklet attached. Here below is the final concept listed

Devision



House



Community hub

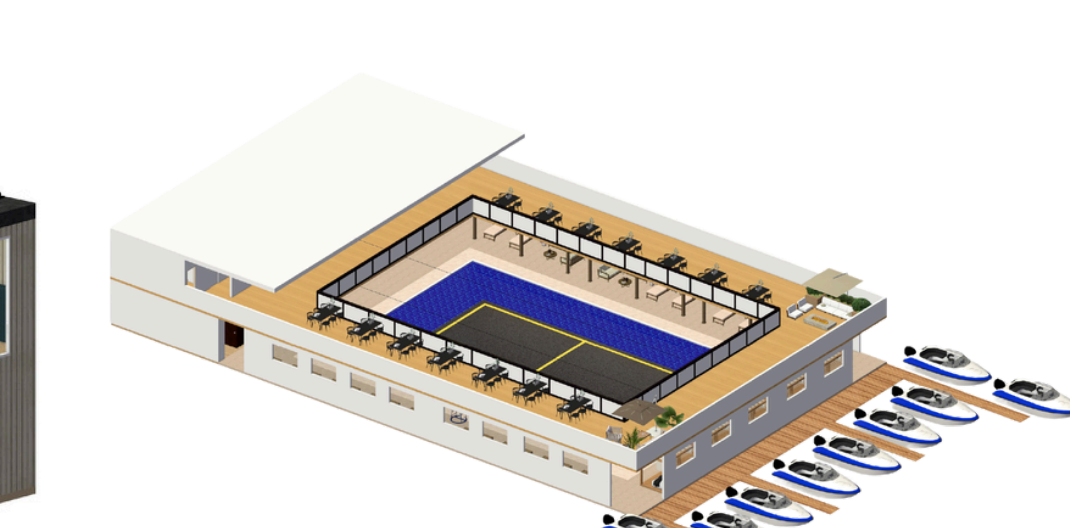
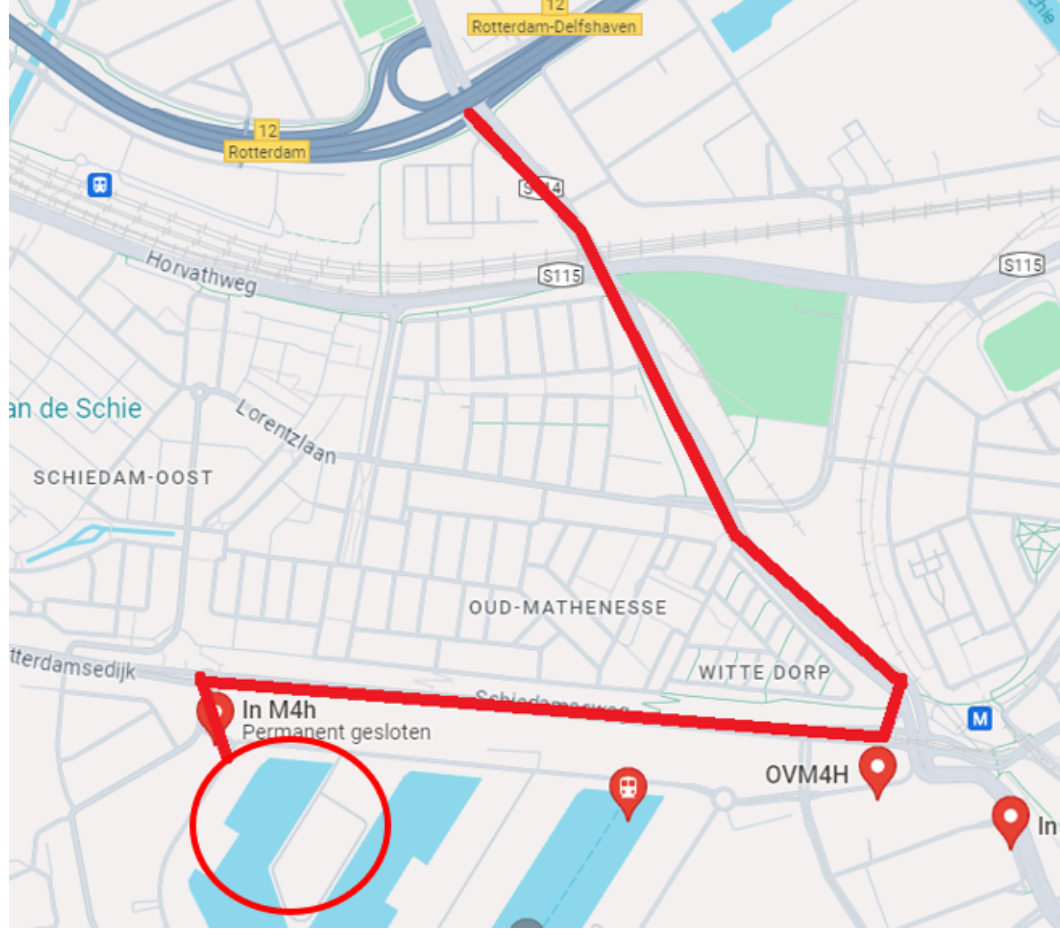


Image 6. Construction site equipment on the site



Source 5

Image 7. Route for the truck from the highway to the construction site



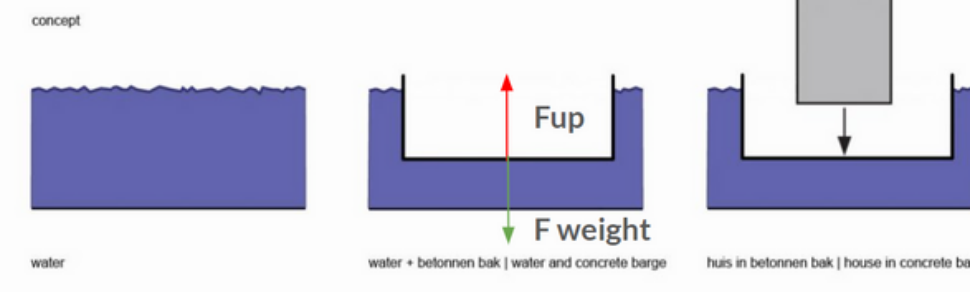
Source 6

Image 8. Example pontoon



Source 7

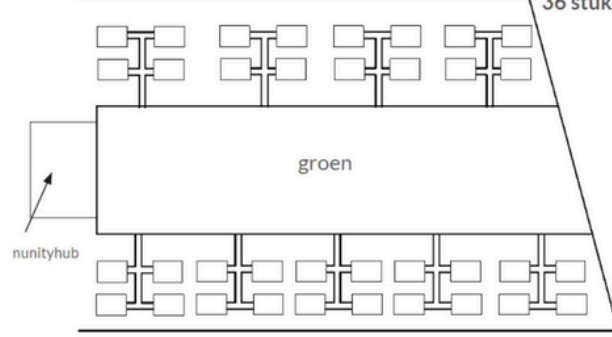
Image 9. The constructive operation of a pontoon



Source 8

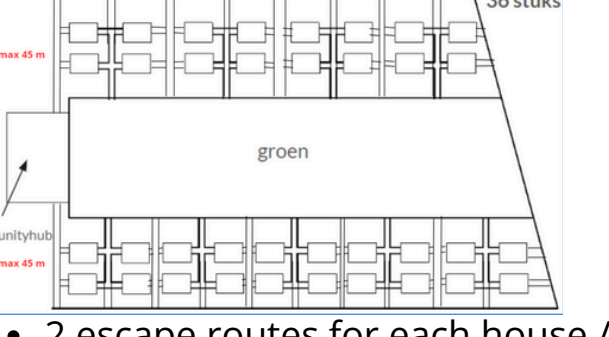
A realistic height of the pontoon is 0.4 metres, but here a specialist can calculate with formulas see appendix. For the minimum reinforcement required, a specialist should also calculate to, see appendix formulas. The construction method on the floating pontoon is timber-frame construction. The timber frame is placed with pre-walls (see detail next poster) and is bolted to the concrete pontoon. You are dealing with dry joints, making the structure demountable.

Before lay-out



- no 2 escape routes
- more than 30 metres escape route

After lay-out



- 2 escape routes for each house / community hub
- not more than 30 metres escape route for each house
- not more than 45 metres escape route for a community hub

Insulation & acoustic:

We chose cork insulation because it:
- moisture-resistant
- has a low lambda value between 0.038 and 0.040 W/mK (KistenKoning, n.d.)
- environmentally friendly, biodegradable and circular (Kurk, n.d.)
- acoustically good because cork is porous (Akoestische wandkurk, n.d.)

Reason for why not the other insulation materials, see appendix

Installations:

From the No Footprint House and trias energetica (see figure at right), we aim to:

- as many renewable energy sources as possible: solar panels and water pump
- high-efficiency installations: heat recovery pump with efficiency up to 95%
- in case you are still short of heated water: connection to district heating
- in case you are still short of electricity: connection to local electricity grid

In the flat ground, you can see that the installations on the ground floor and first floor are one above the other. This makes installing pipes easier.

See next poster for photos.

Construction site

We have chosen a large storage so that the precast HSB elements can be stored. The intention is to use the storage as little as possible, because we want to assemble the delivered precast HSB elements right away.

There are also two waste containers on the construction site, this is to separate waste and to keep the construction site as environmentally friendly as possible.

The shack is located to the left of the entrance and not within reach of the crane. This was chosen to ensure the safety of the workers.

The shack has room for 8 people. A maximum of one crane operator and 7 tradesmen will be present at the construction site at the same time (RECO, n.d.).

Route and transport on the construction site

Since the construction site is close to the highway, we chose to transport the material using a truck. The chosen construction method is wood frame construction, so on the truck the wooden elements are tied and transported from the supplier to the construction site. Timber frame elements are compared to concrete and steel very light elements and easy to transport by truck.

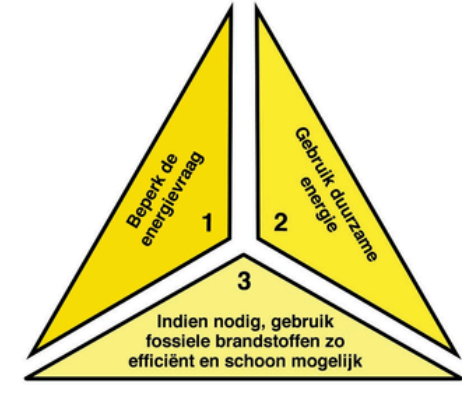
Arriving at the construction site, the truck will use the additional adjacent road which is drawn in black on the construction site layout. Here the truck will stop so that the small mobile crane can lift the precast HSB elements from the truck.

At the construction site, the Prefab HSB elements are assembled into a house. Then, using a pontoon, the houses are placed on the concrete floating raft and placed in the right place in the water. The horizontal transport we use are trucks, mobile cranes and pontoons. The vertical transport we use are scaffolding and a construction hoist.

Construction:

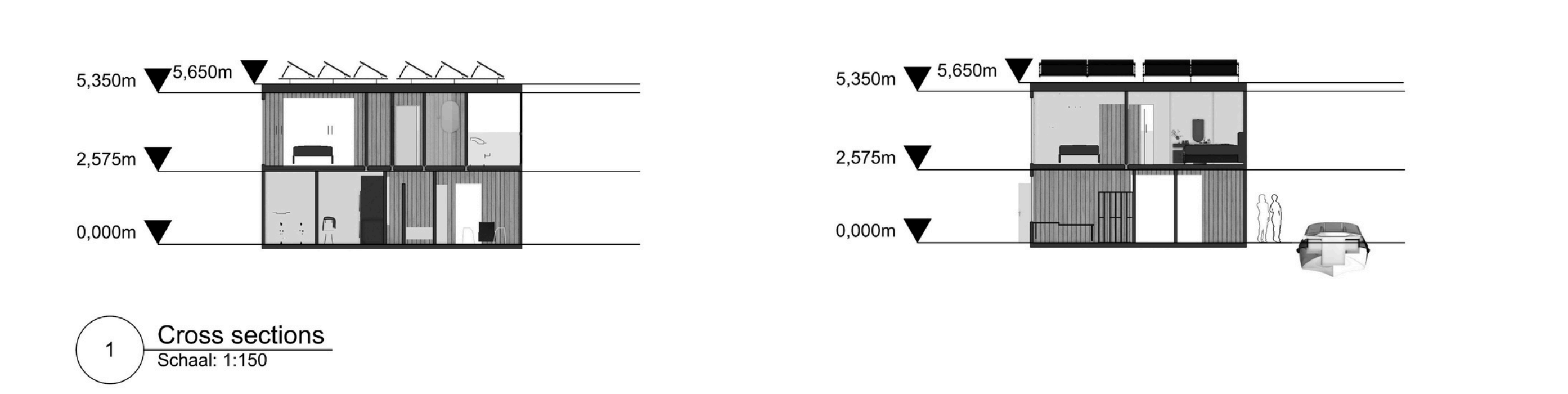
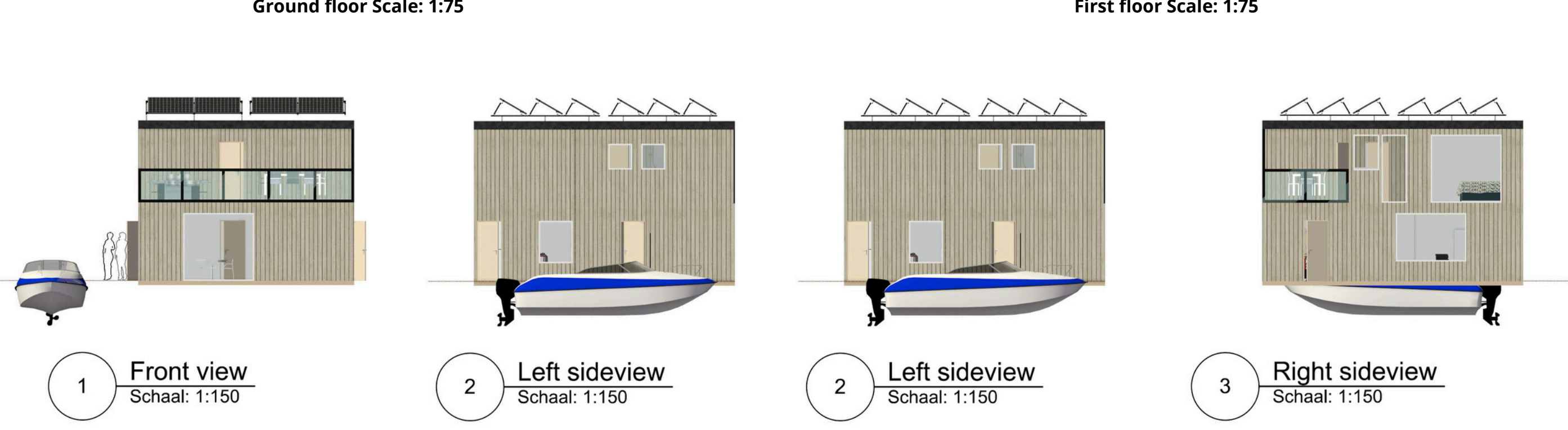
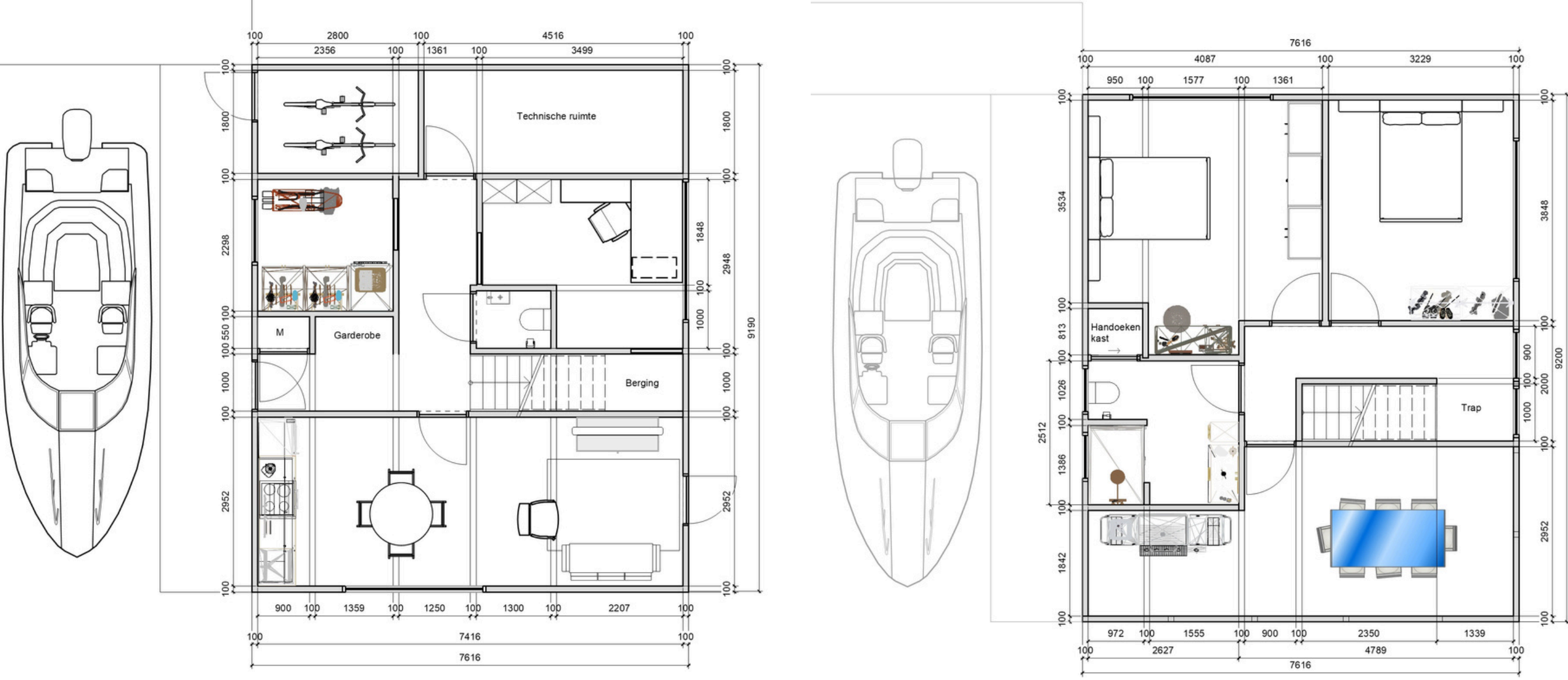
We choose a concrete pontoon as the structure because of its stability and construction time. We realise that concrete is no more sustainable than recycled barrels, for instance. However, safety in terms of fire safety and stability outweighs durability for us. The material used is Liapor concrete (lightweight concrete). These are clay pellets in the concrete. (Betoniek, 1990)

Image 10. Trias Energetica

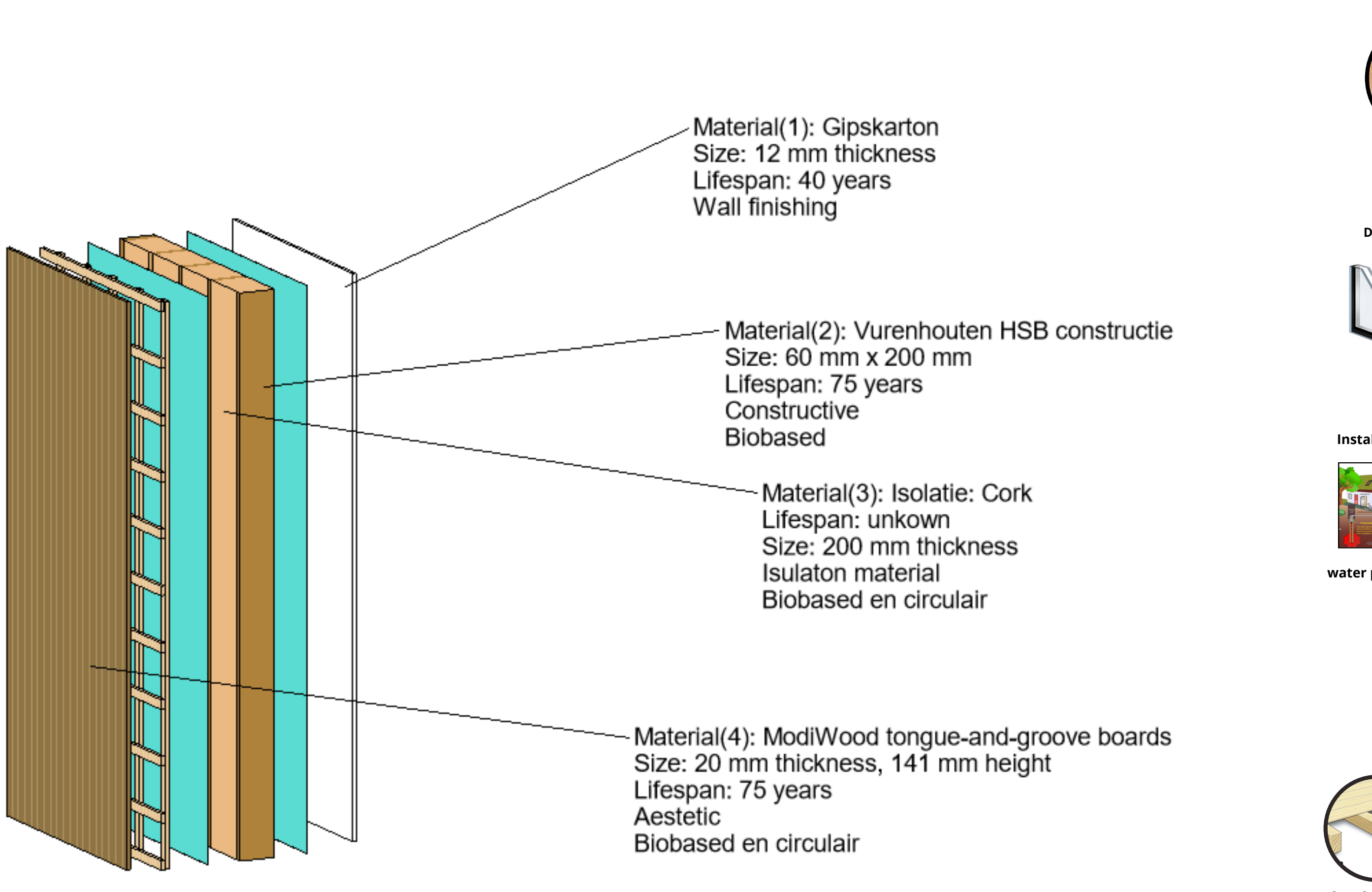
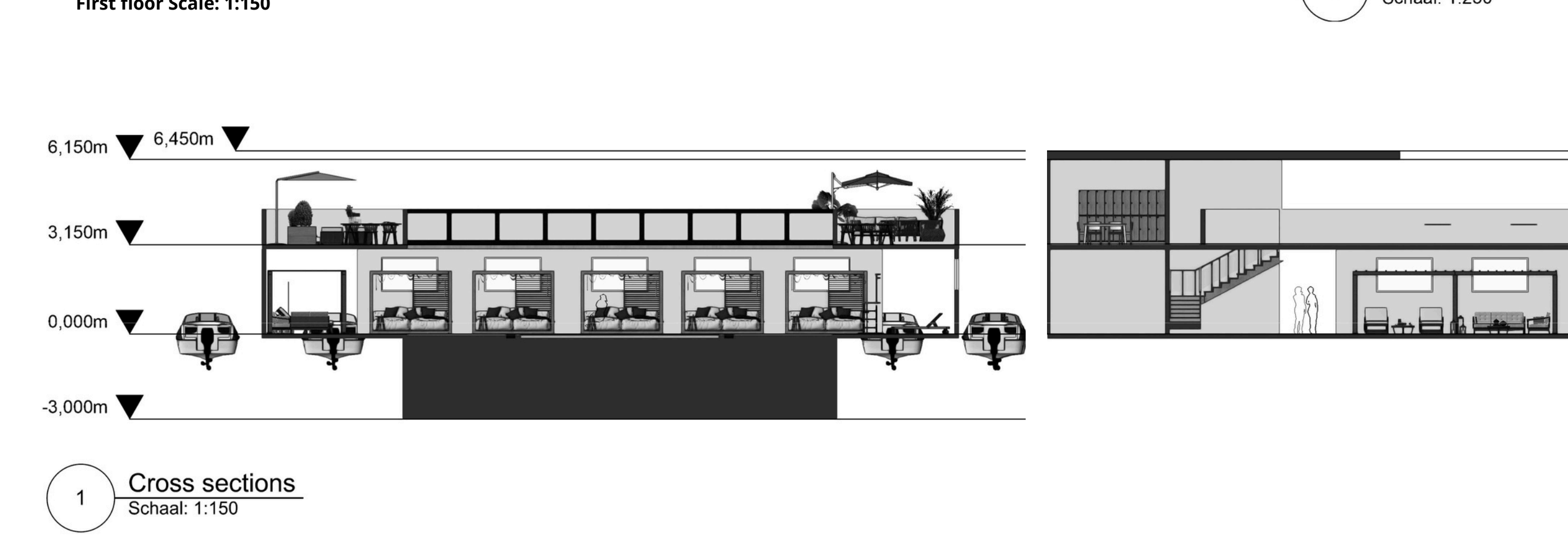
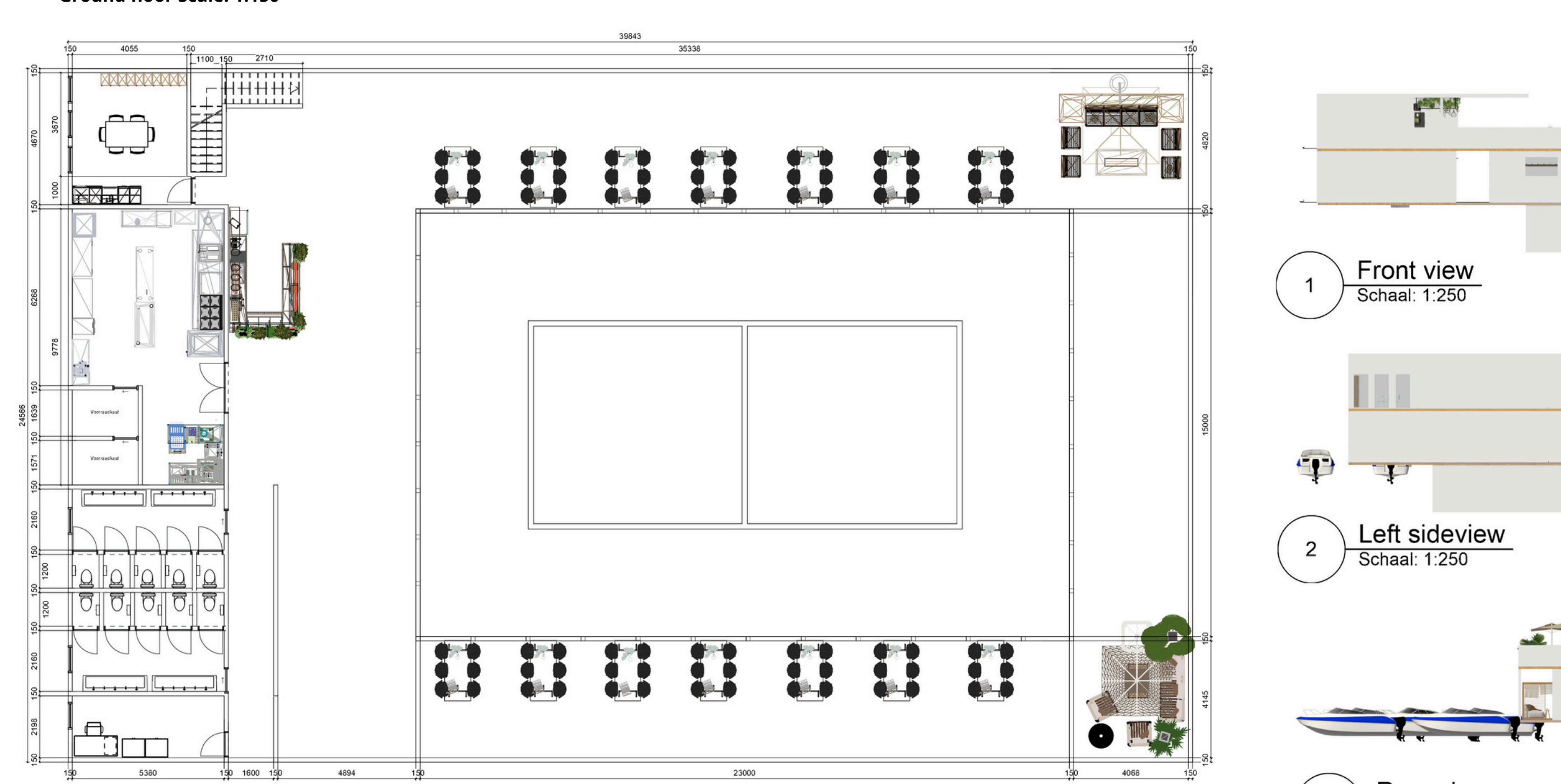
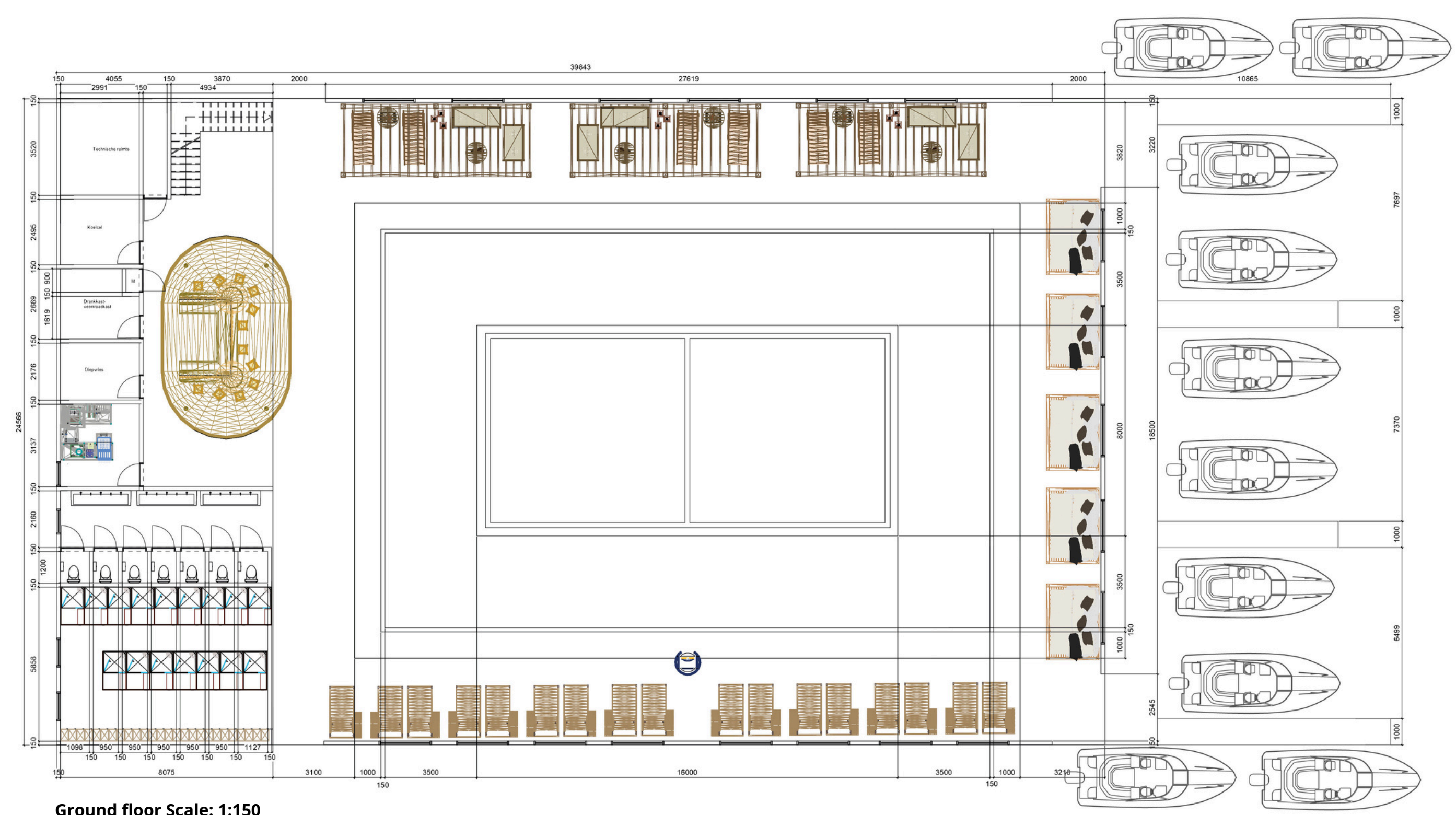
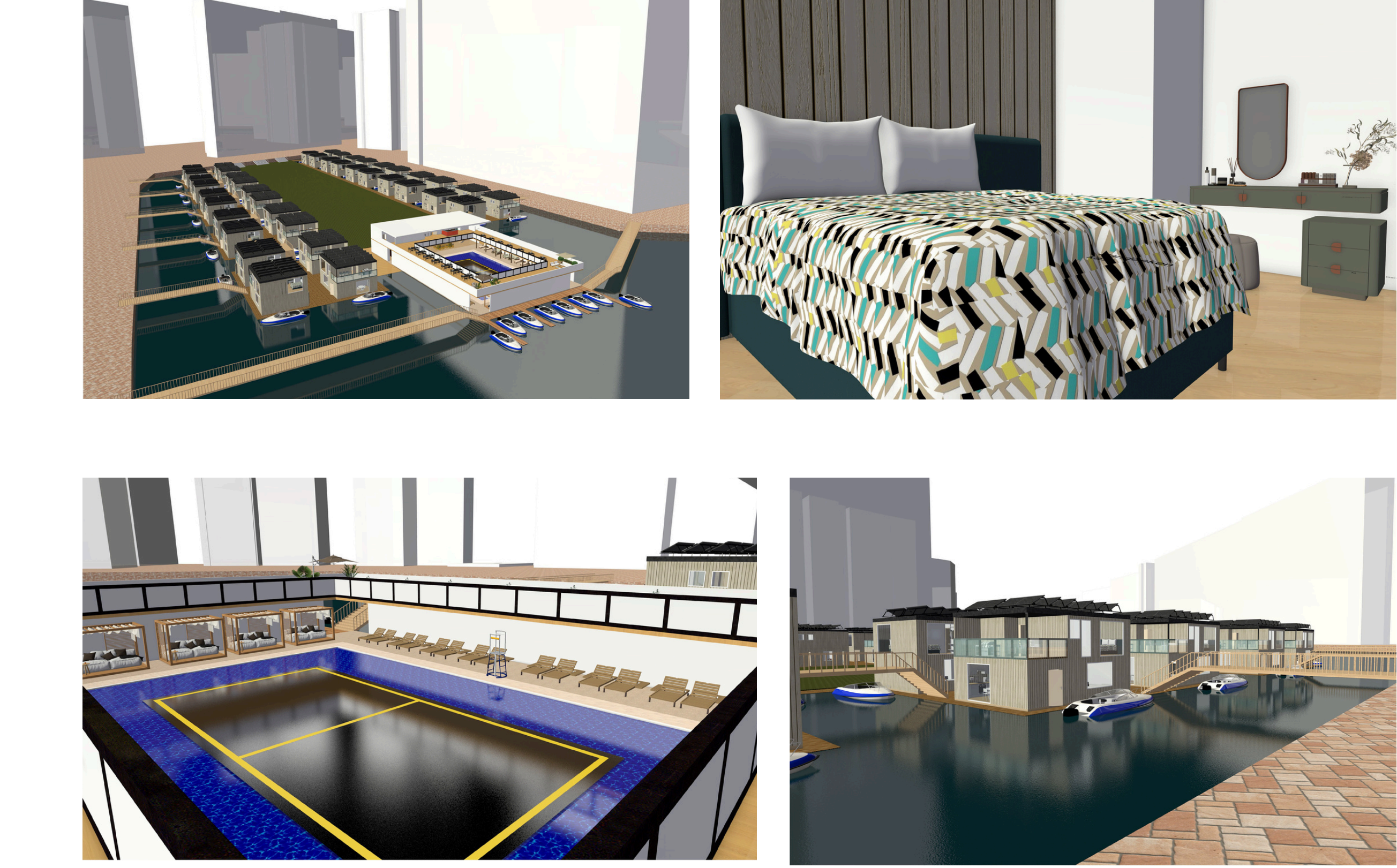


Source 9

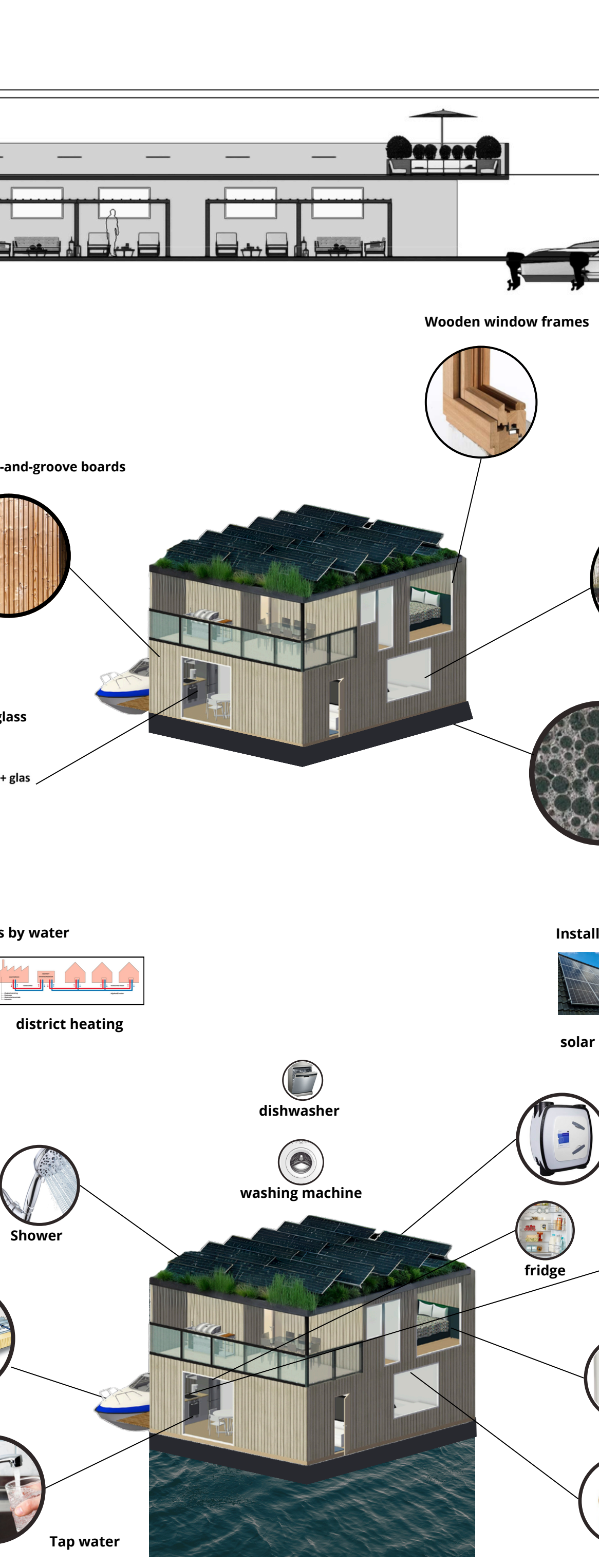
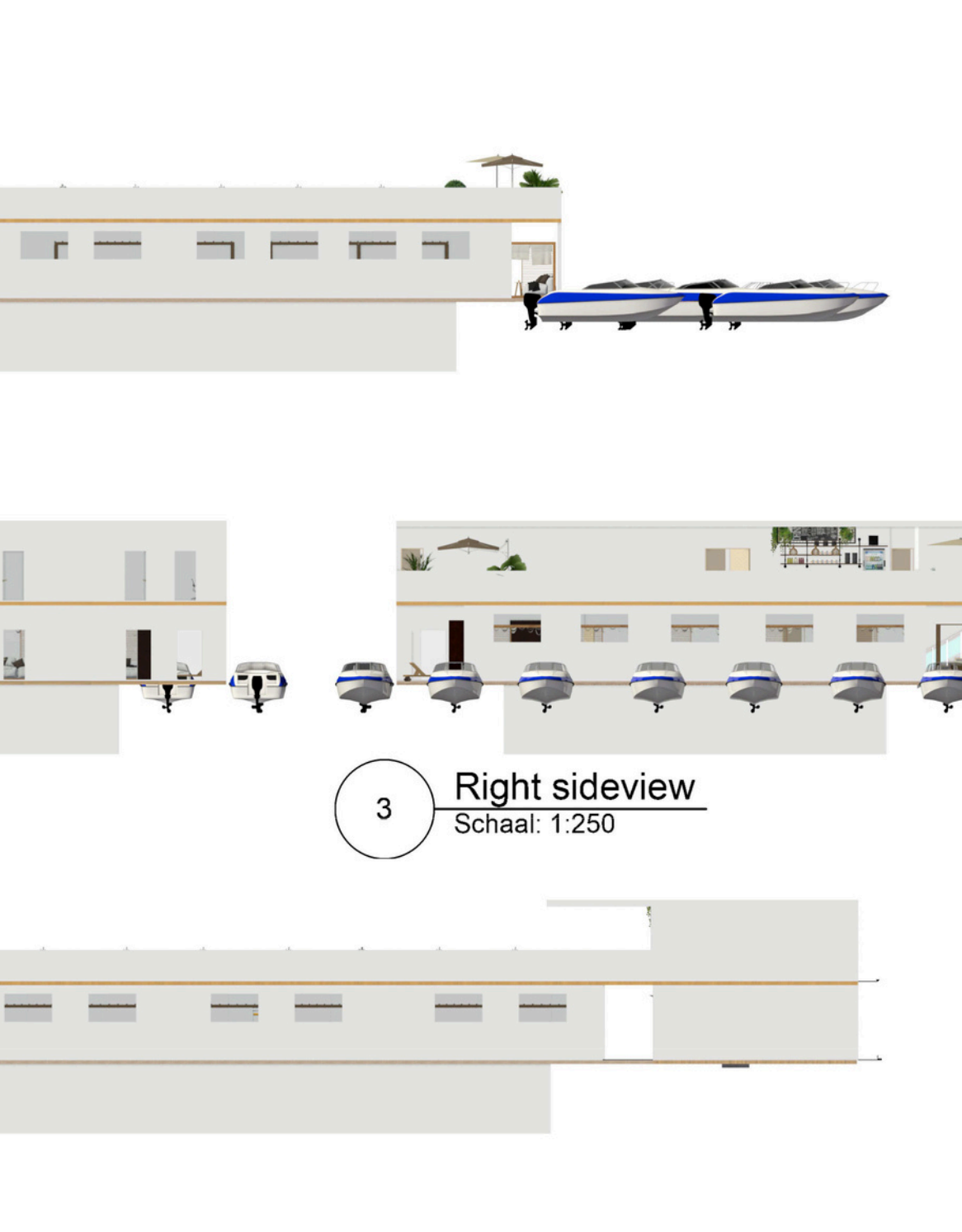
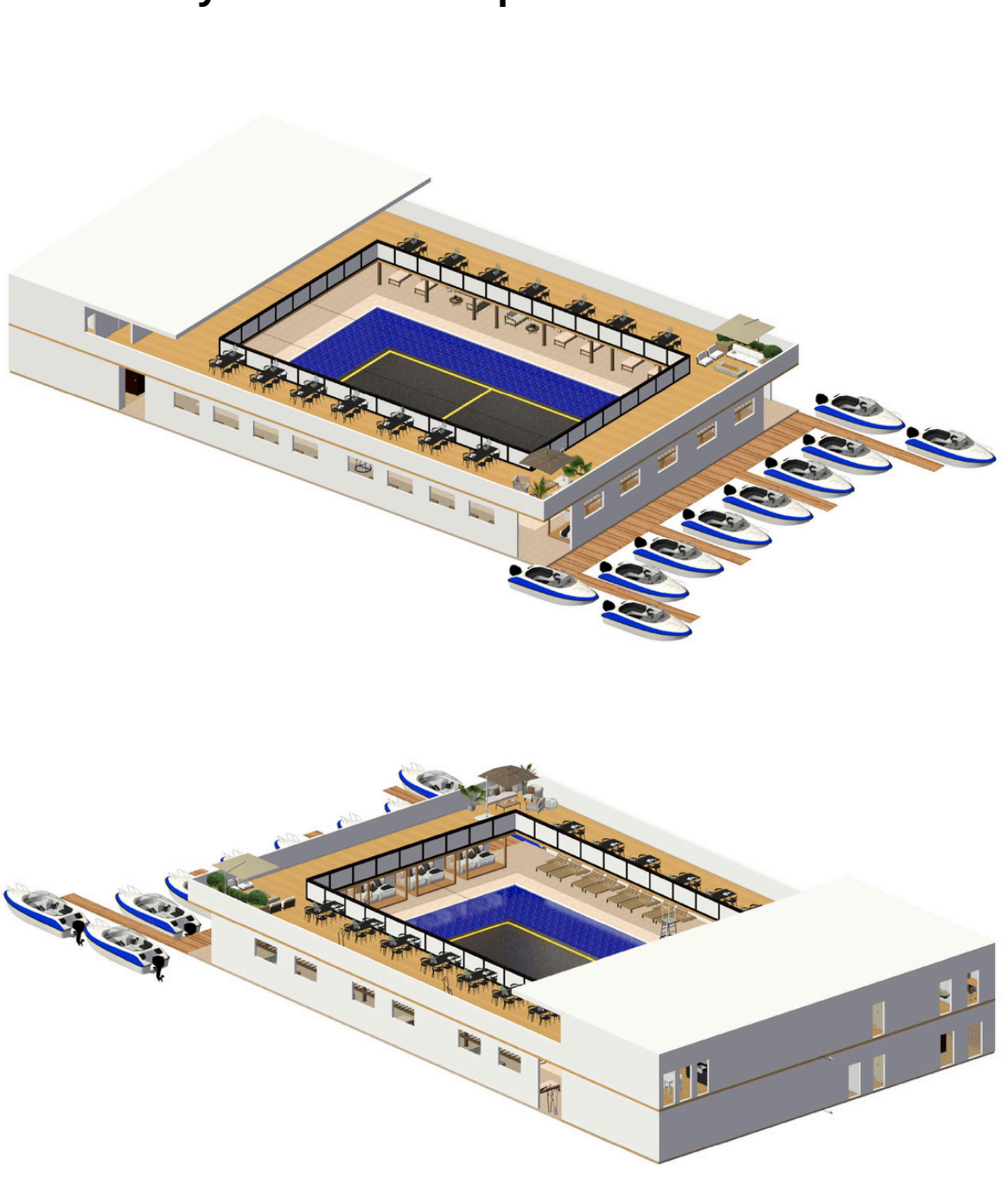
Housing - Artist Impression



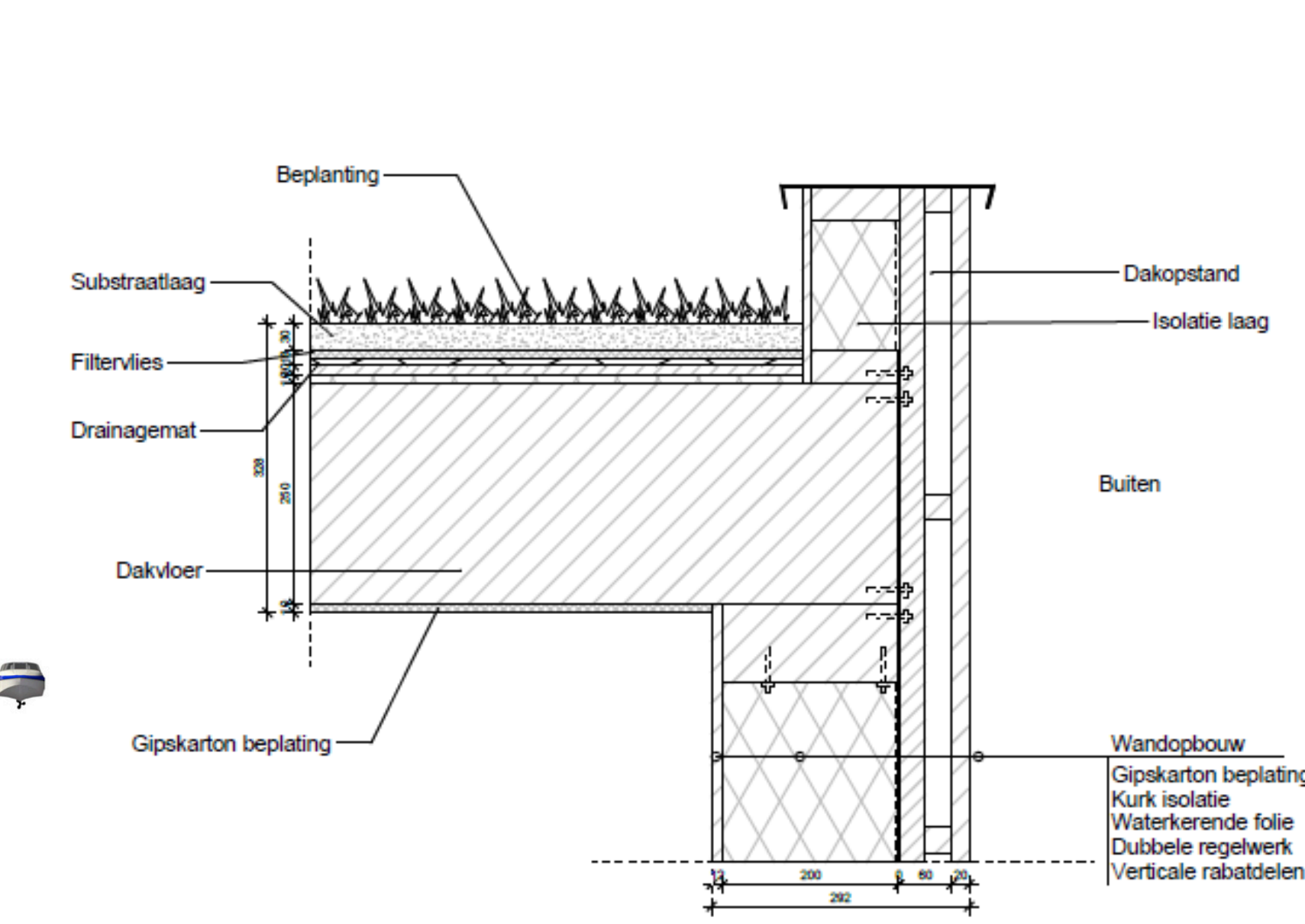
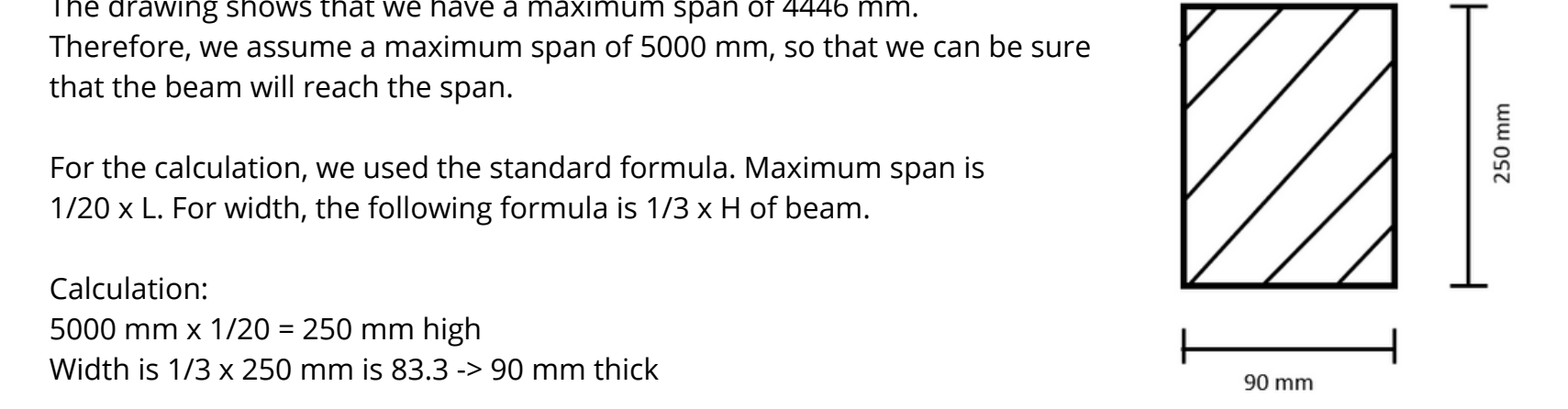
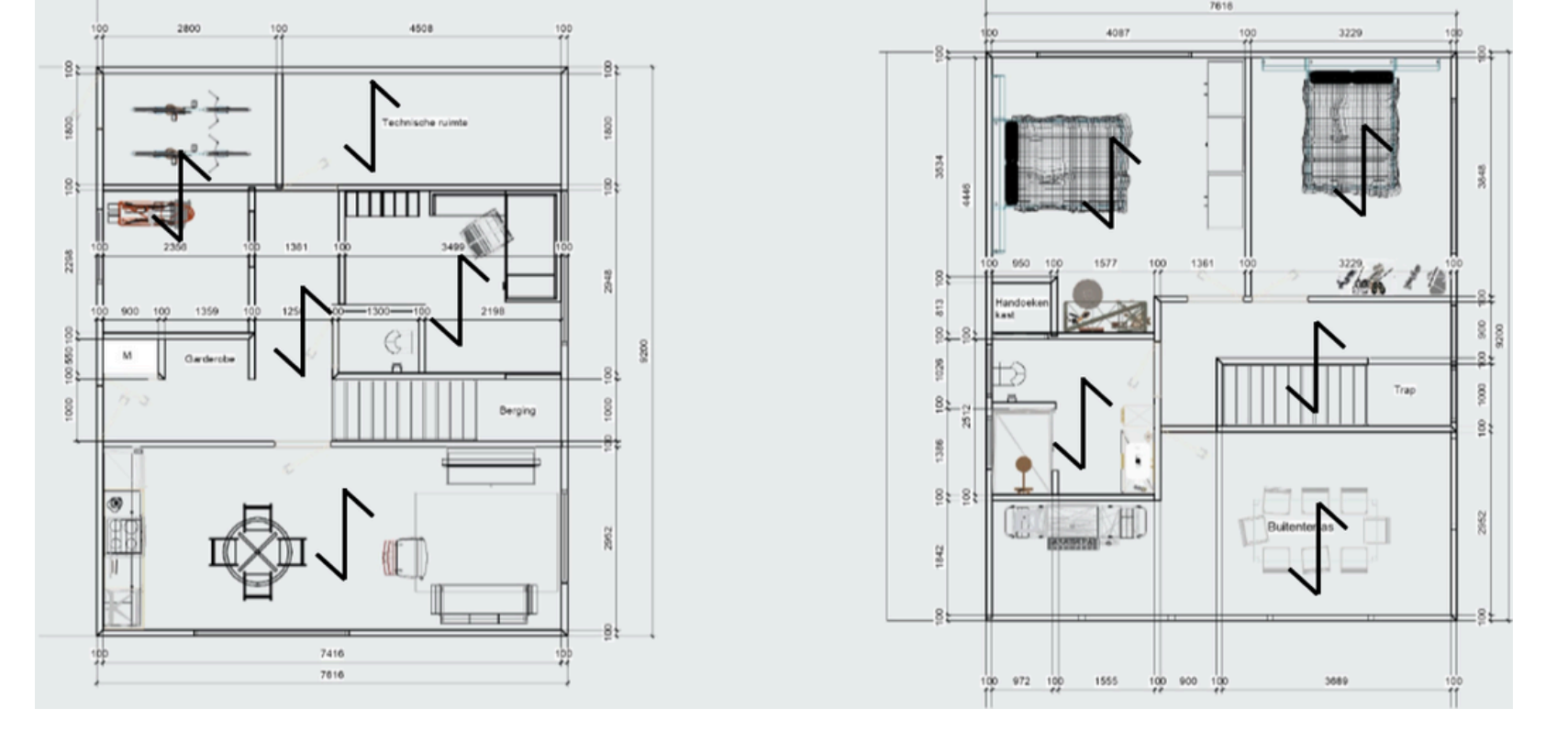
Artist Impression



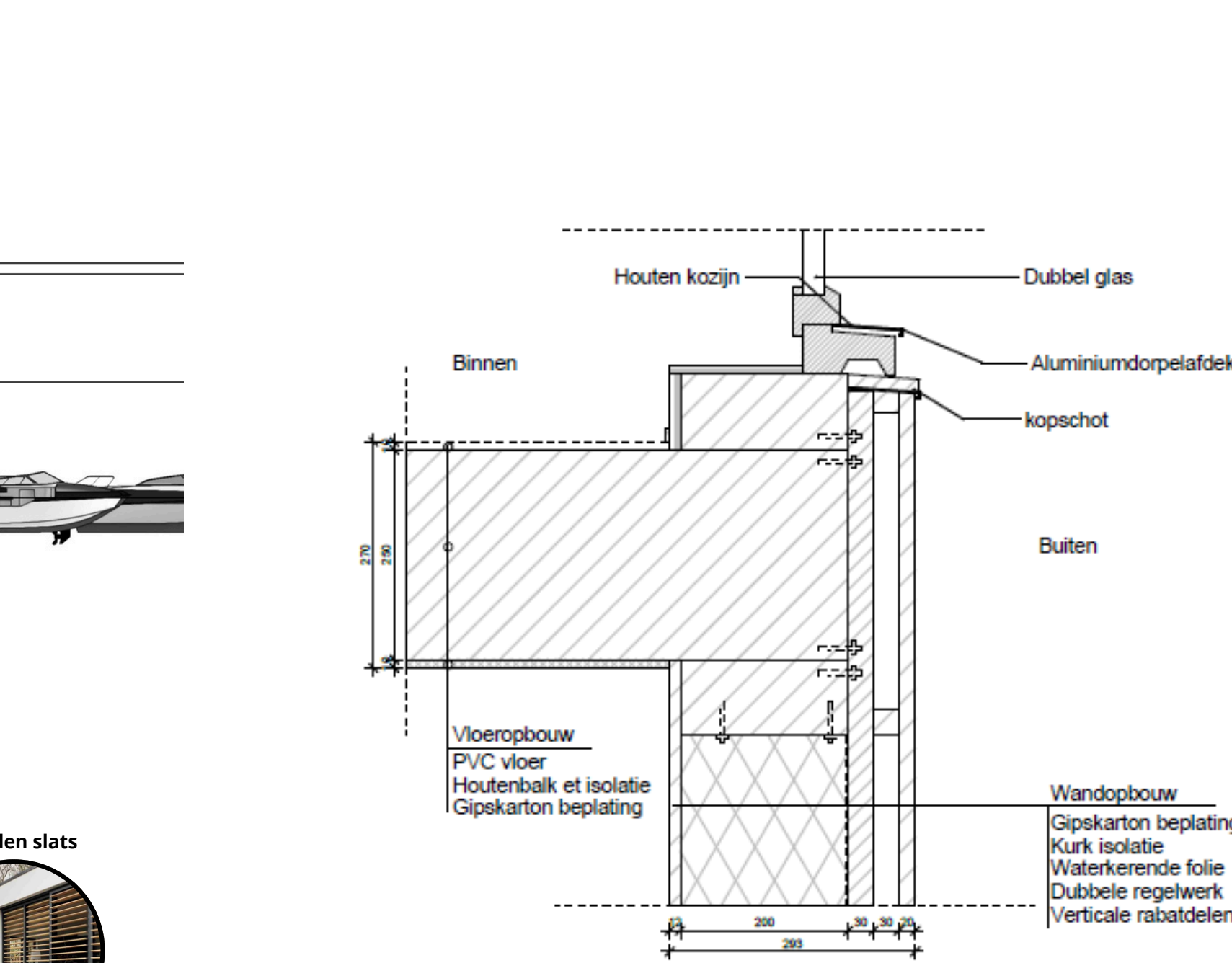
Community Hub - Artist Impressions



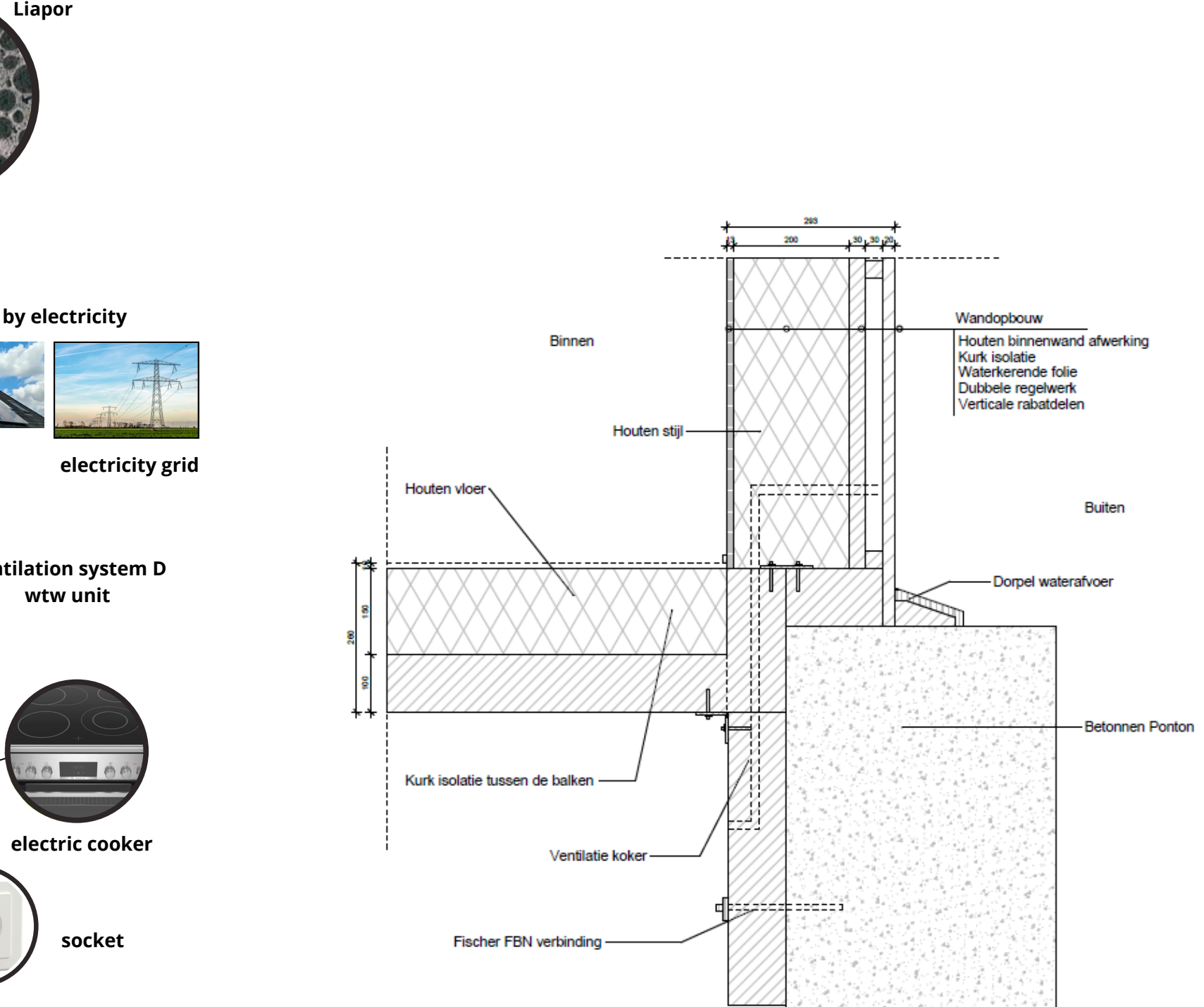
Calculation of timber frame beams



Detail 03 Connection of roof floor to wall + green roof



Detail 02 Connection floor to wall + frame



Detail 01 Ground floor/wall connection on pontoon