

RESEARCH QUESTIONS

A no-footprint house is energy neutral, it has no negative influence on the environment. The no-footprint house in Costa-Rica isn't actually fully emission-free, but it comes very close. We want to go a step further and make a house that has a positive influence.

MAIN QUESTION:

How can we build a house that absorbs more CO2 than it emits?

SUBQUESTIONS:

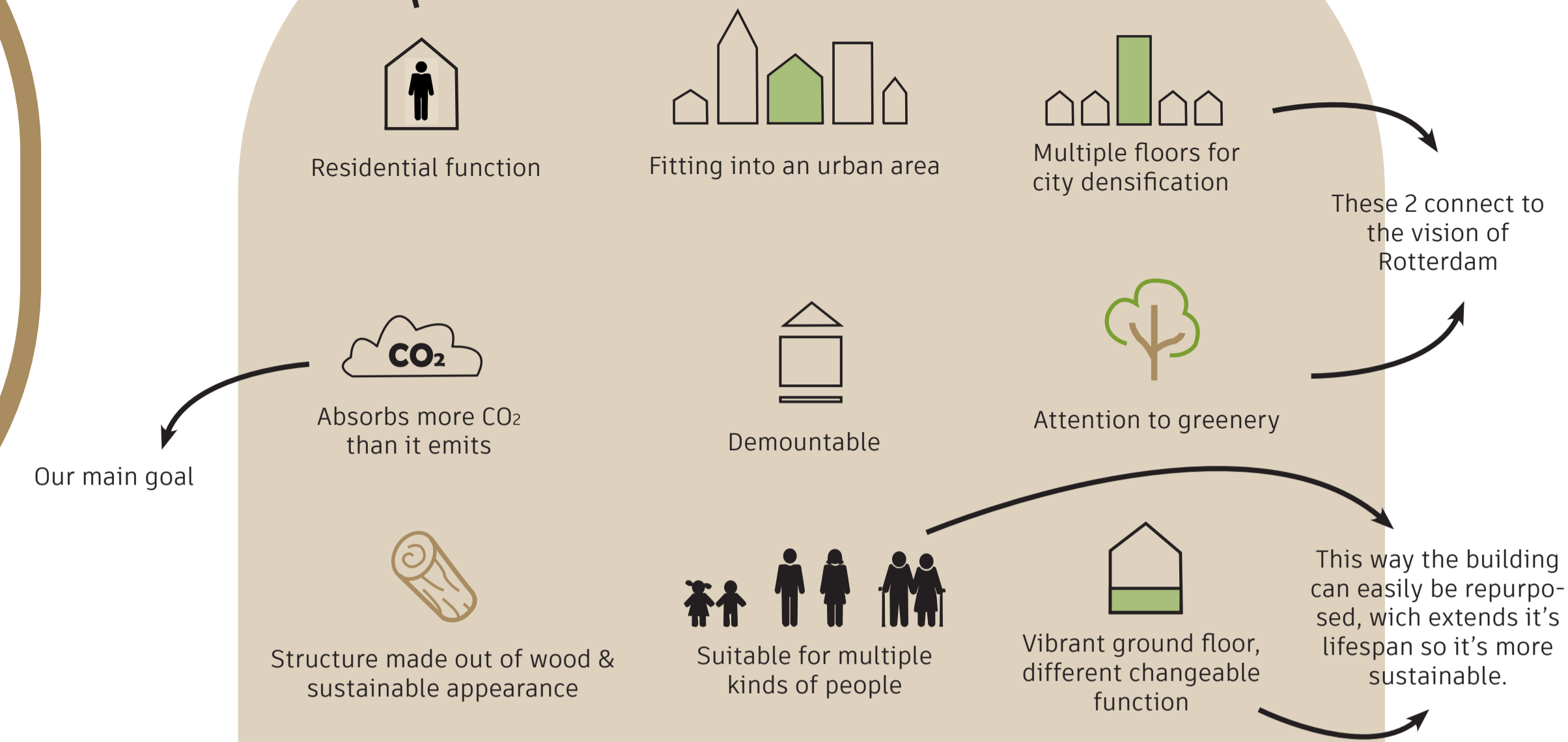
1. **What** is a no-footprint house? Which parts makes the Costa Rica house **not completely emission-free**? And how can we **improve** these?
2. What should we take into account when placing the no-footprint house into an **urban area**? **Where** will the house be placed in Rotterdam?
3. **Who** is the house meant for?
4. What environment friendly **materials** are we going to use?
5. How are we going to **transport** these materials to the site and how are we going to **build** the no-footprint house.

NFH BUILDERS

International project no-footprint house

To help solve the housing shortage in the Netherlands

DESIGN REQUIREMENTS



ANALYSIS COSTA-RICA HOUSE

WHAT DOES A NO-FOOTPRINT HOUSE MEAN TO US?

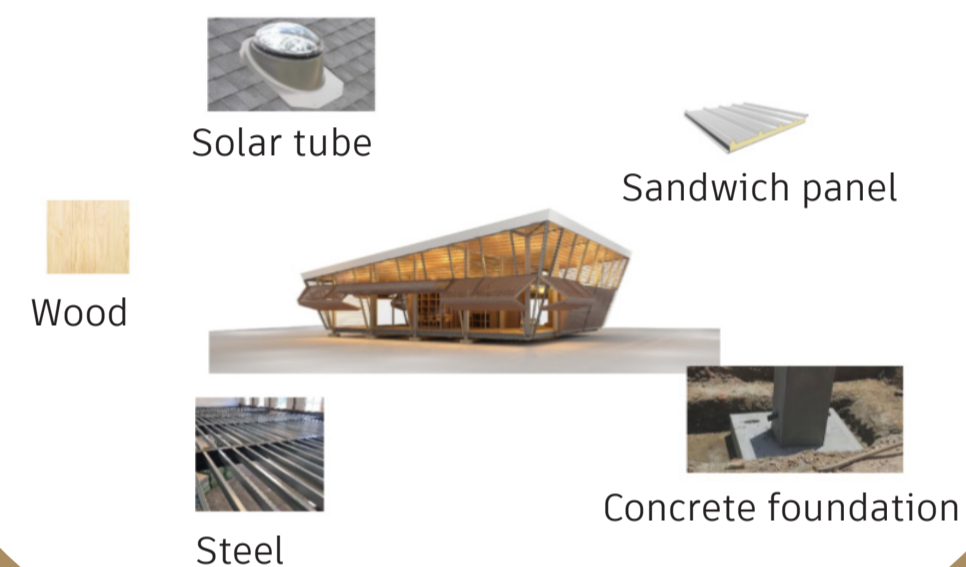
- Sustainable materials
- Self-generating energy
- Usage of rain
- Absorbs more CO₂ than it emits

WHAT CAN WE IMPROVE LOOKING AT THE NO FOOTPRINT HOUSE IN COSTA RICA SO THAT IT'S EMISSIONS-FREE?

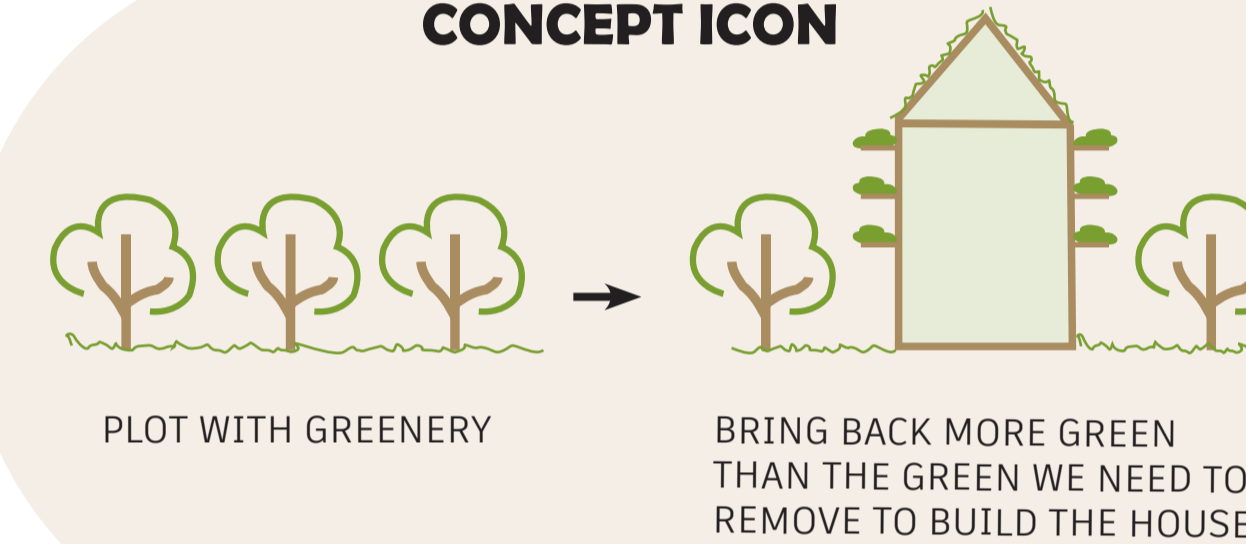
The problem with the Costa Rica house lies in the materials. The building is mostly made out of wood, which is very durable, but not all the materials are just as environment friendly. We want to use local and reused materials to reduce the footprint as much as possible. So we are going to swap some of the building materials from the original no-footprint house.

1. Support structure of steel -> support structure of wood
2. Foundation of steel and concrete -> removable foundation of meerpalen and stelconplaten

MATERIALS USED



CONCEPT ICON



PVE

- 10M X 20M
- 4 floors
- 6 houses
- 2-3 bedrooms
- Large outdoor space
- Nice view
- Flexible floorplan
- 'Portiek' routing

CITY VISION OF ROTTERDAM

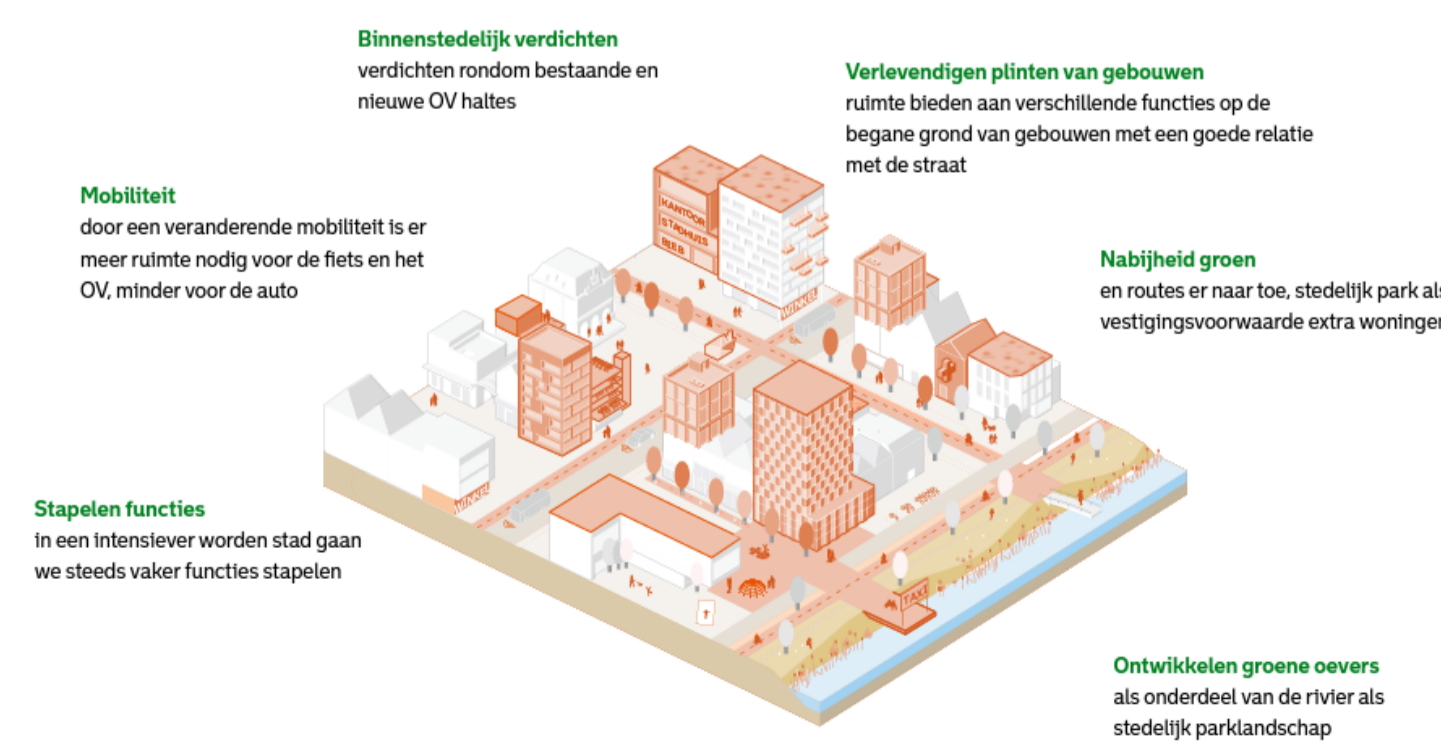
We have examined the city vision to determine what the requirements are of a building that fits into a urban area. The city vision comes down to:

- Sustainable city densification
- Multiple functions within a building
- Usage of green
- Vibrant ground floor

We want to include these points in our design.

TARGET AUDIENCE

We want to make our building suitable for multiple kinds of people. Our floorplan should be adapted to these diverse target audiences. Our ground floor function is interchangeable so it's also suitable for multiple target groups. Because of this the building will be more sustainable. When the target audience or the ground floor function is obsolete, the building doesn't have to be demolished. Instead it can be repurposed for something there's a lot of demand for from its surroundings.



Stads Visie Rotterdam. (z.d.)

THE FOUR E'S

Equity

The shortage of houses in the Netherlands is a big problem. So we decided to make a flexible floorplan for different target audiences. For example, you can remove a wall to create more space, or add a wall to create a new room.

Economy

We used as much second-hand materials as possible to give them a second life. But also to support the economy of Rotterdam by using materials in the surrounding. The costs are also lower because of that.

Engineering

Because we build on meerpalen and stelconplaten, we had to build as light as possible. We also implemented different durable installations. So that's something we had to work out as well.

Environment

The plan is to use as much materials as possible from Rotterdam. This leads to less CO₂ emission used to transport materials. Our ground floor can be used for something other than a home. This is also flexible.

THE LOCATION

Rotterdam is a Harbor City. That is why the harbor is the perfect location for our prototype. This is the Mullerkade, Llyodkwartier.

We also chose this location because there is an impressive view, good public transport, many facilities in the area within walking distance.



According to the bestemmingsplan of this neighbourhood we are allowed to build in the area, because it's marked as a residential area.



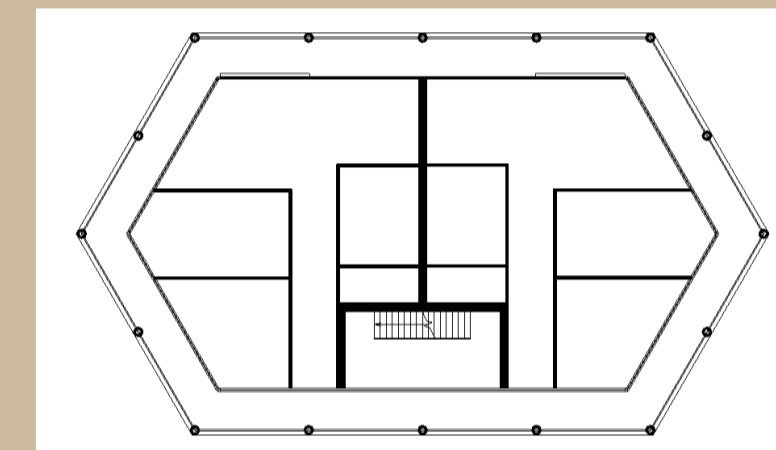
The lot is green and we like to keep it that way.



DESIGN OPTIONS

VARIANT 1: Jan

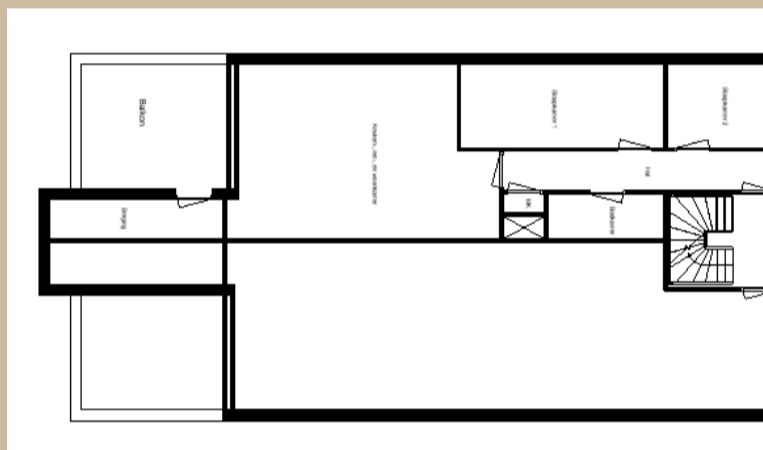
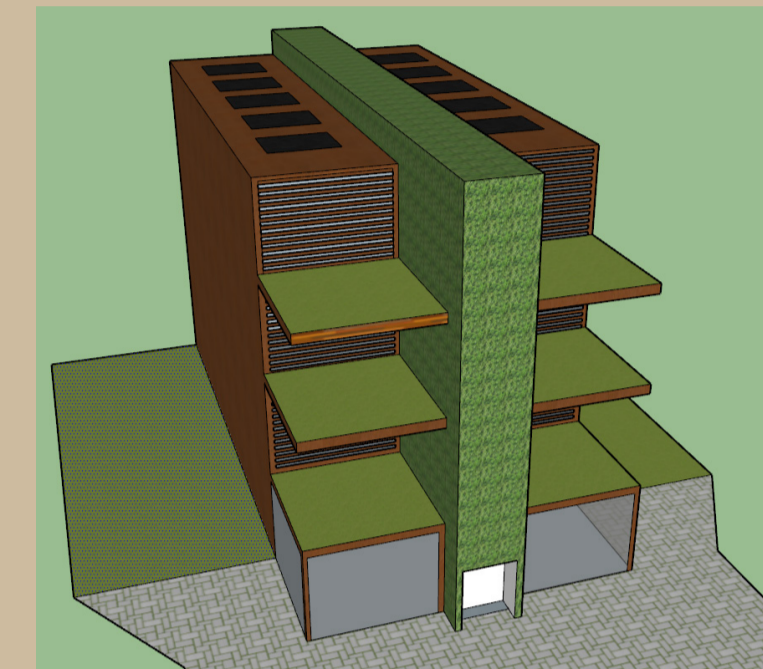
I wanted to design a building with as much greenery as possible. This is in line with our research-question. For this I used the "Bosco vertical" project in Milan as a source of inspiration. This building uses a lot of greenery on the facade and on the balconies. My design has a 360 degree balcony with room for a lot of plants.



EENVOUDIGE INDELING				
NO-FOOTPRINT				
FLEXIBELE INDELING				
INTRISSANTE VORM				
HOEVEELHEID GROEN				
OPPERVLAKTE BUITENRUIMTE				
MAKKELIJK UITVOERBAAR				

VARIANT 2: Noa

I think that the most efficient way to design a building that has a positive influence on the CO2 problem is to include a whole lot of green. I have designed green balconies and middel part of the building consists of a green wall and roof. I have referenced the house in Costa Rica by using the same slats as a front facade.



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VARIANT 3: Priyanka

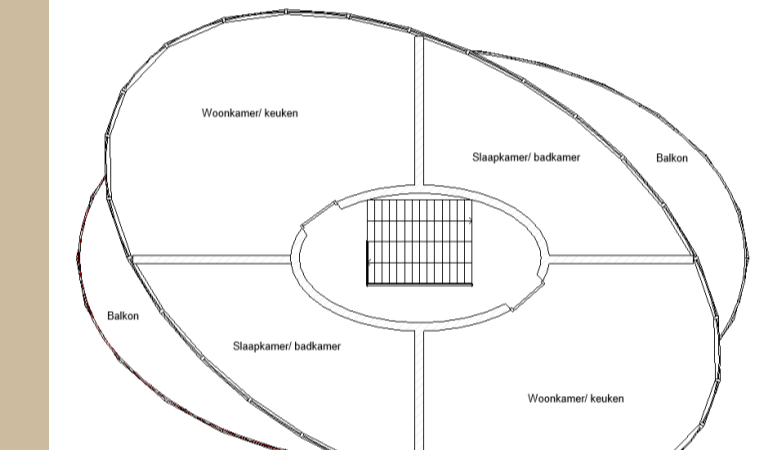
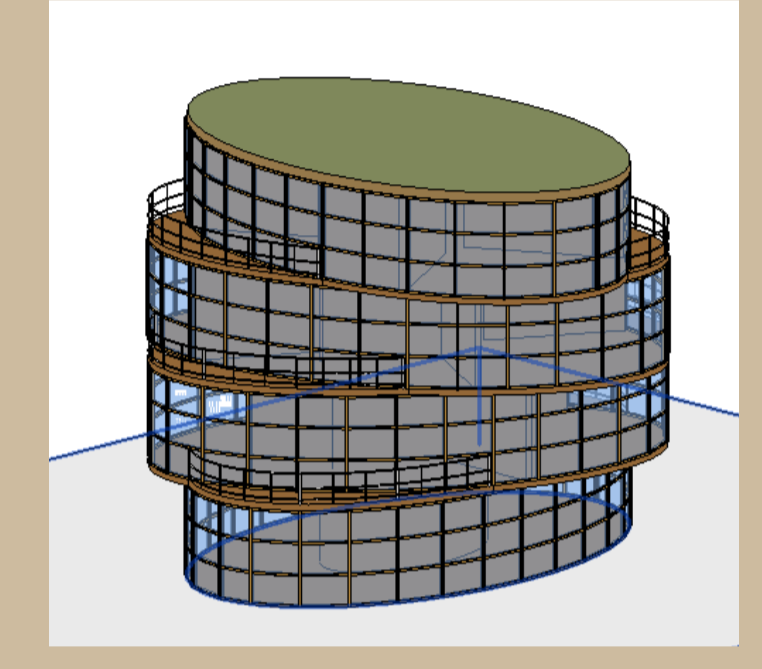
I have used my reference for my variant (see attachments). I have designed a traditional Dutch building with elements from the no-footprint house in Costa Rica. This way it will fit within the urban setting of Rotterdam. I chose to place the rooms with installations in the middel of the floorplan, just like the NFH house in Costa Rica. This way the house will have a free lay-out. The materials used are biobased or reused (wood).



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VARIANT 4: Kiet

With my design i thought of a way to implement nature in a building, and to let it look like a building based on nature forms. Thats why i came up with this round design. When i think of nature, i think of organic shapes and round shapes. So thats why my building is round. And with a lot windows for naturel light to come in.



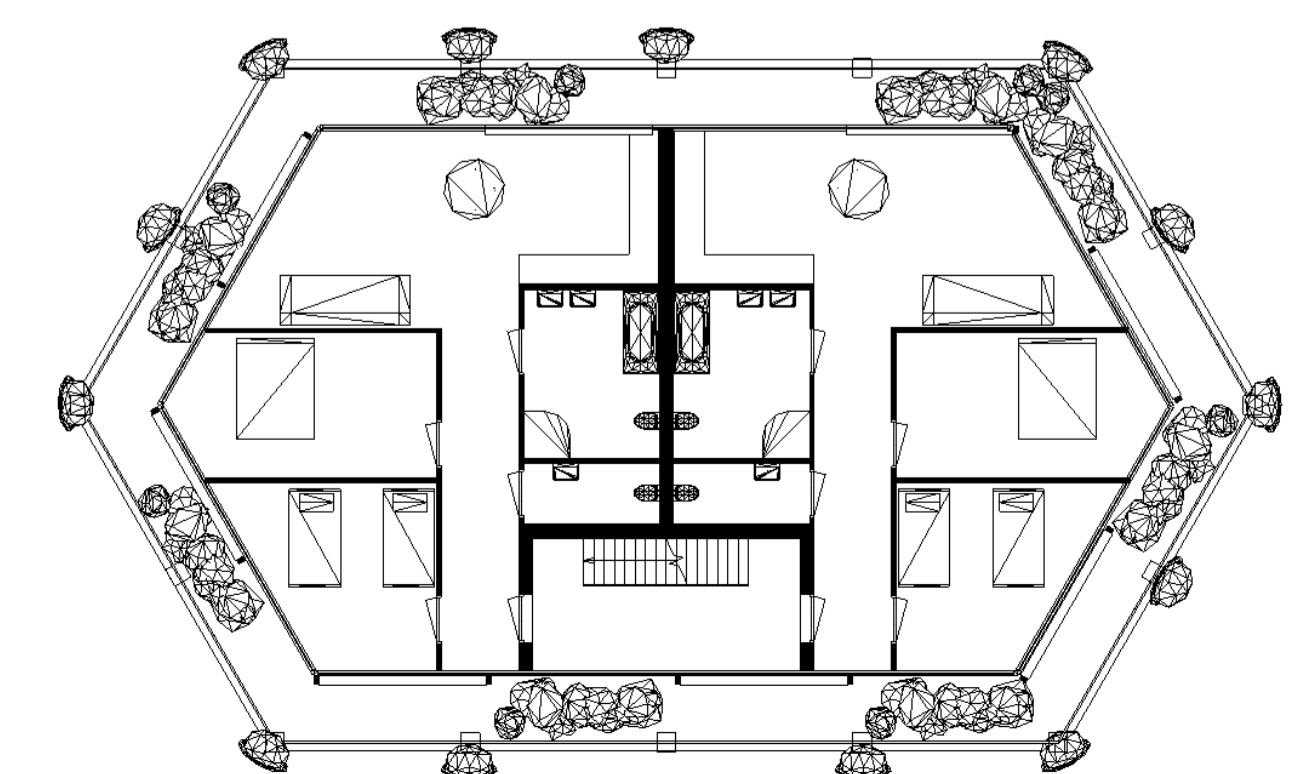
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CONCLUSION

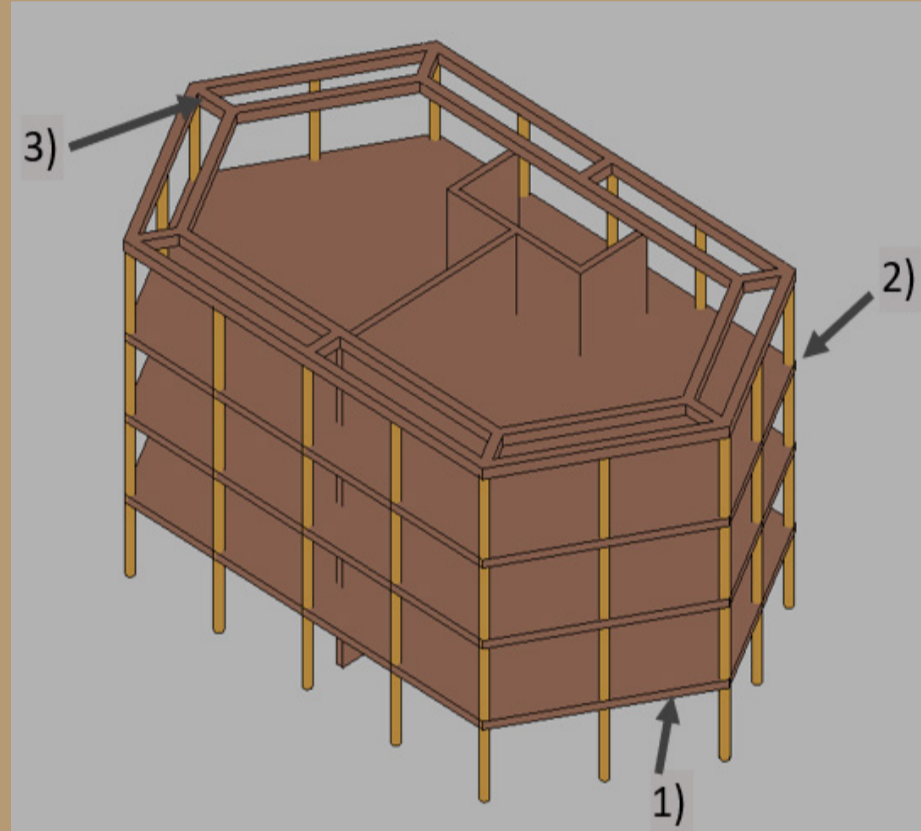
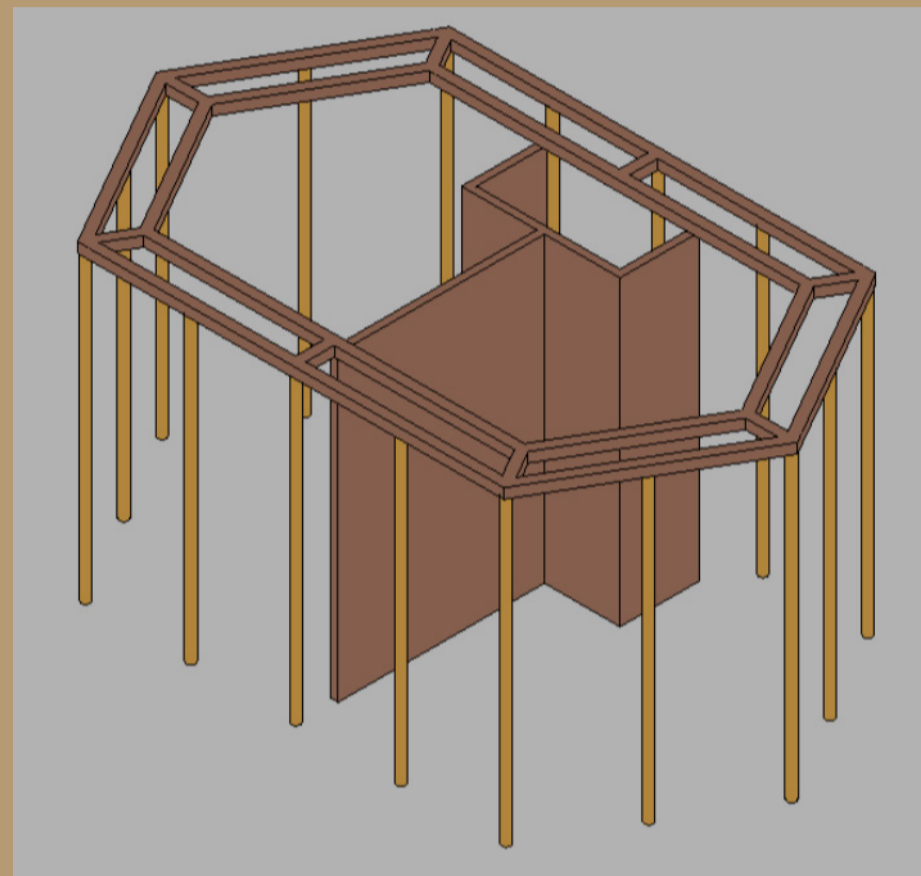
We compered our different design options by using a harris profile. The first variant scored the highest and we are going develop this design further during this project. However at the moment it isn't 'no-footprint' enough. So we want to include more green into the design.

FLEXIBLE FLOORPLAN

Our goal is to have the floorplans as flexible as possible. So it's easy to adjust to a different target adience. This way all sorts of people can live in this building, so it doesn't have to be demolished, because it can be repurposed for a different adience if there's more demand from the neighbourhood. The bedrooms can be combined or split just by moving the innerwalls around.



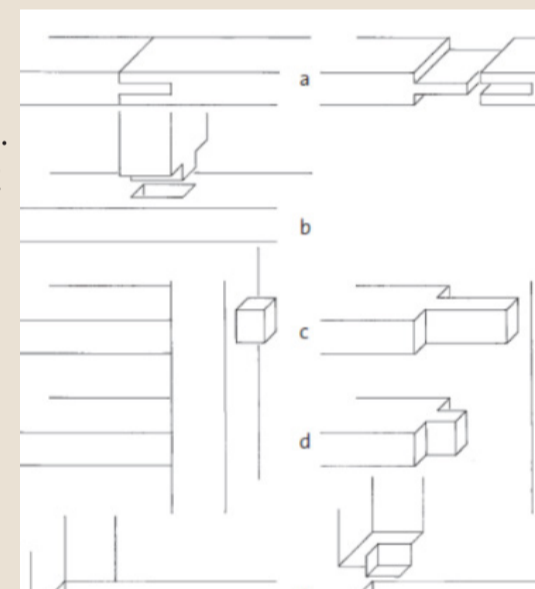
CONSTRUCTION



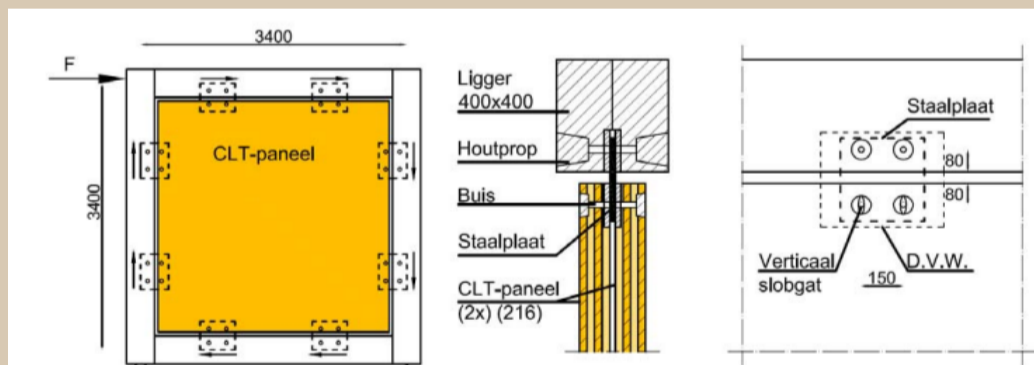
In order for the building to stand properly, the elements must be well connected to each other, but it must also be possible to take it apart, so that is a challenge. The construction consists of CLT (load-bearing interior walls and floors) and mooring posts (columns and beams). These construction parts support the entire building. The construction parts are connected in different ways and are listed below.

1.

For our project we will use bolt connections and sliding connections. we are going to connect the floors in a sliding connection and we are going to do that in way A (see figure opposite). This ensures that the floors are easily pushed together.



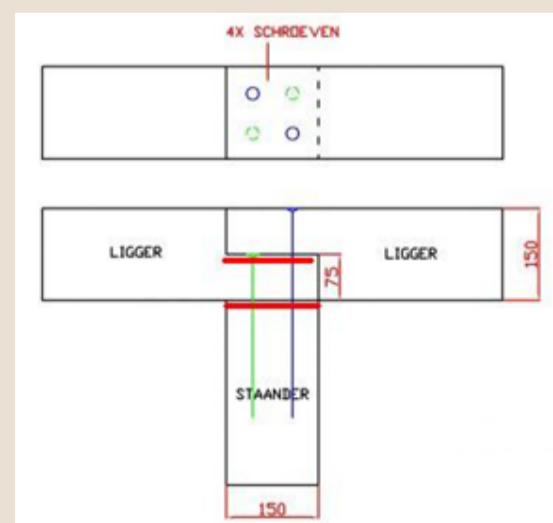
2.



We will use brackets for the column/floor connection. This can be seen in the figure below. The difference is that we have the floor flush against the columns.

3.

The beam/column connection is done by bolt connections and by some kind of sliding principle. The beams run into each other and both rest on the column. Next to this text is a sketch of this connection



MATERIALS

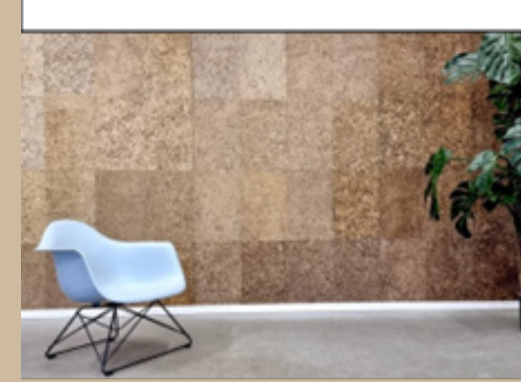
We wanted to use a material especially from Rotterdam. We are using meerpalen and stelcon-platen, which come from the harbor of Rotterdam. The products are local en reused.

We came up with inner plates made of seawood. This inner plating is made by a small innovative company called BlueBlocks. All of our inner plating will be made of this product. This is to support the local innovative workers in Rotterdam, and to give smaller company's a change to show their products. The inner plate of seawood looks good, brings the sea into our design and supports the people of Rotterdam.

Bollard (foundation & construction)



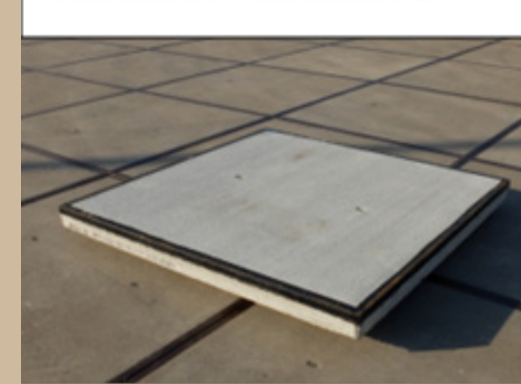
seaweed plates (inner plating)



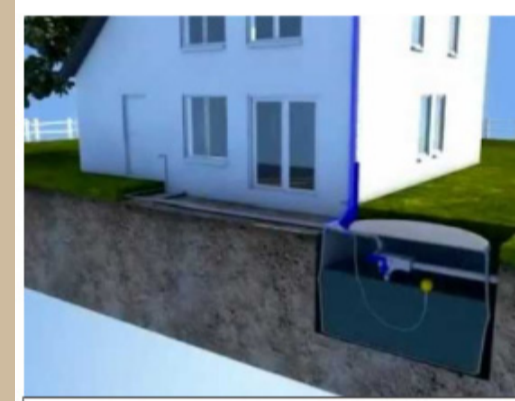
EverUse isolation (isolation)



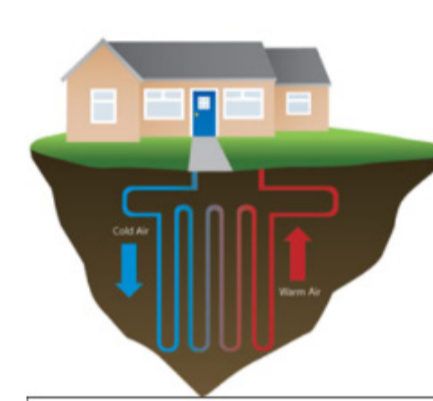
stelcon plate (foundation)



INSTALLATIONS



Gray water system



Groundwater heat pump



Pv panels

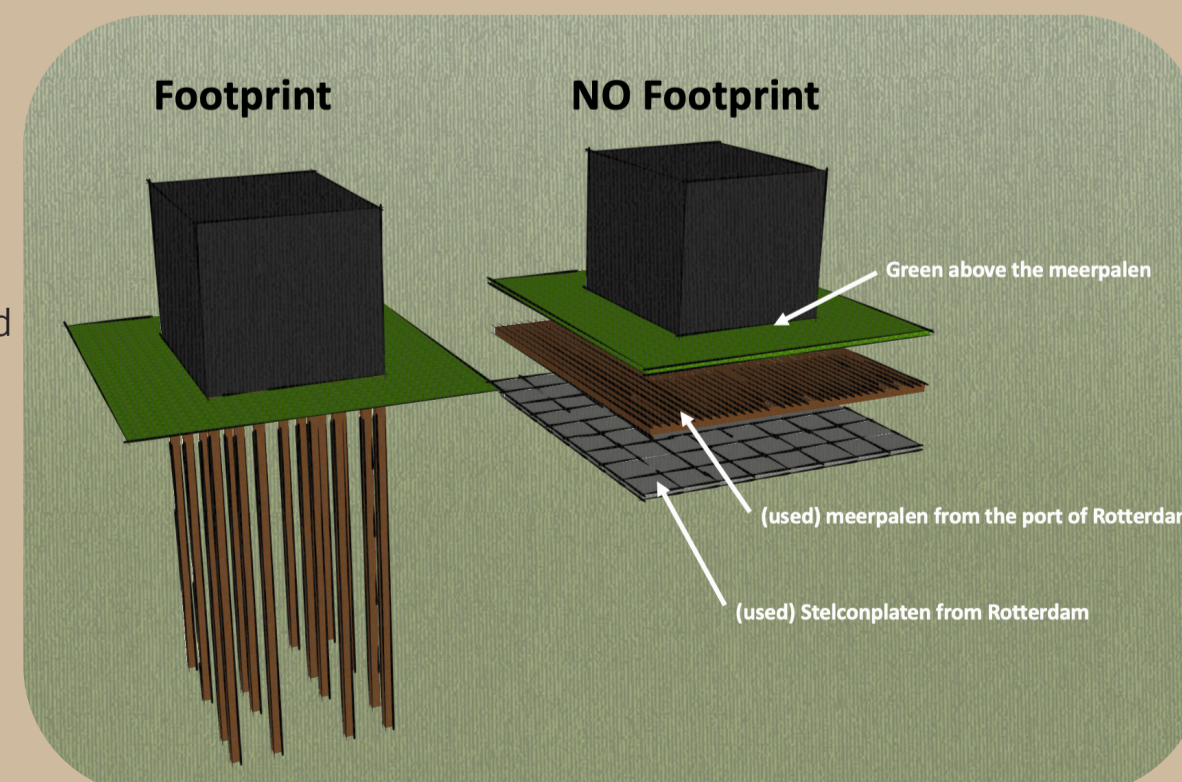
A gray water system is using dirty water from for example douchewater. This water can be used to flush the toilet and saves a lot of water.

A groundwater heatpump is using underground water as there source for heating. The groundwater gets to the surface and the heatpump gets al the heat out of it. The heat is used to heat the building.

The speak for themselves. We will place the pv panels on top of the roof. We will use the pv panels for electricity and we want to used them to charge the electrical cars of the resident.

FOUNDATION PRINCIPLE

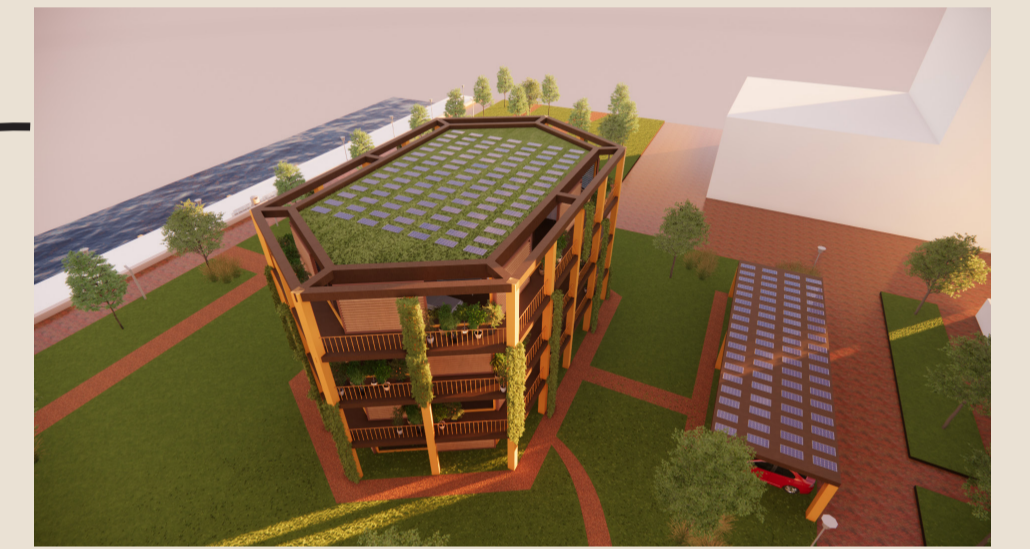
For an ordinary foundation the foundationpoles would be right under the building an not removable. We wanted the entire building including the foundation to be demountable. So we used a foundation made of 'meerpalen' and 'stelconplaten' from the harbor of Rotterdam. This kind of foundation is quiet, local, recycled and removable. This foundation principle is executed before, but only with 1 floor. We need it to support 4 floor, so we are going to spread the wheight across a larger area around the building.



RENDERS



Greenery all over the plot, construction and balconies.



Solar panels on the roof of the building and above the parking spaces. If people drive a electric car they can charge it for free, because we want to encourage more people to drive electric.



We have referenced the Costa Rica house by using the slads infront of our facade. People can move these panels around by themselves, so they can decide where they want shadow in their home.

