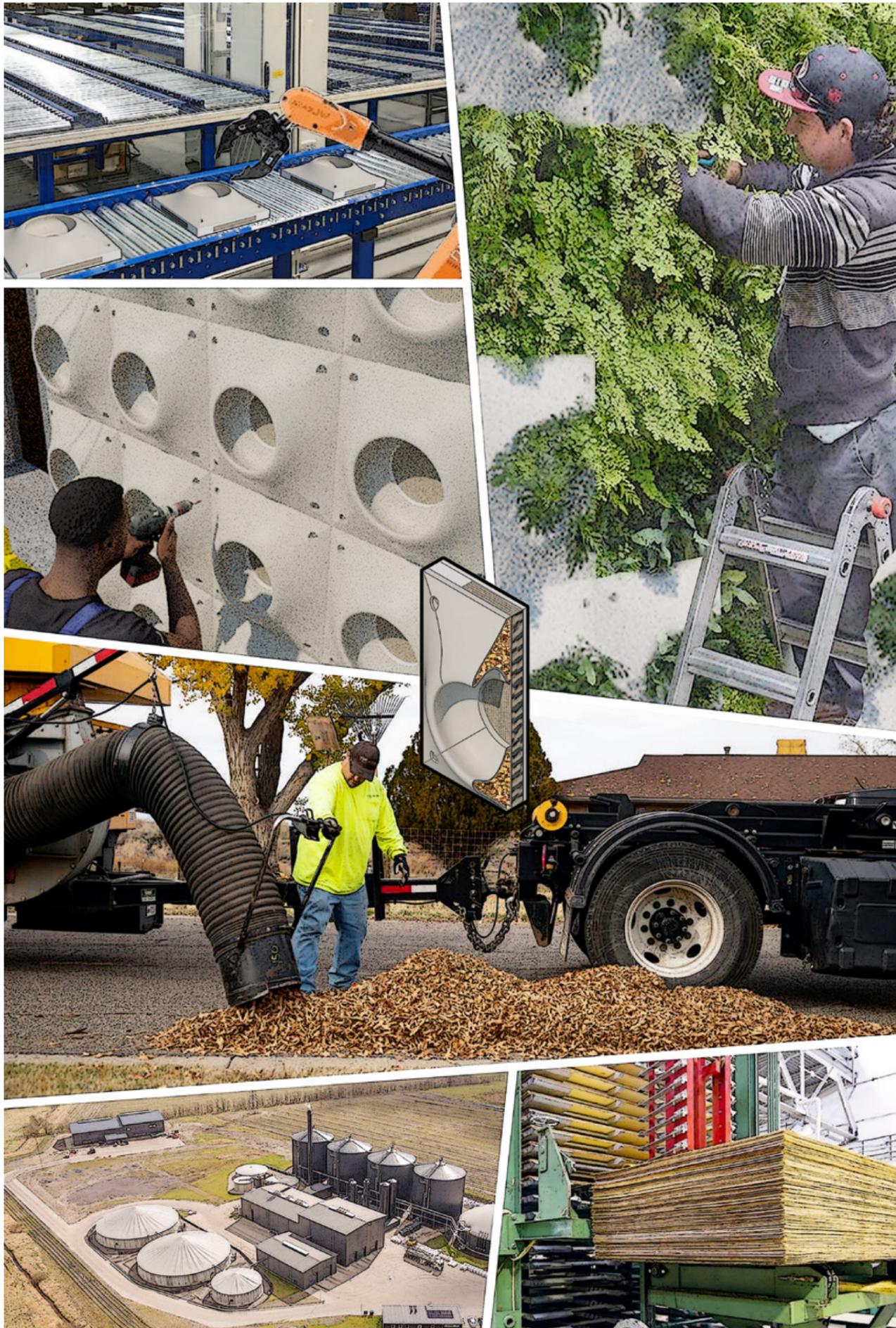


[CHANGING]

GRADUATION PORTFOLIO OF
ZHICHEN GONG
2021-2022





01

CITY AS FOREST

STUDY ON CARBON SEQUESTRATION MATERIALS FOR FAÇADE PLANTING

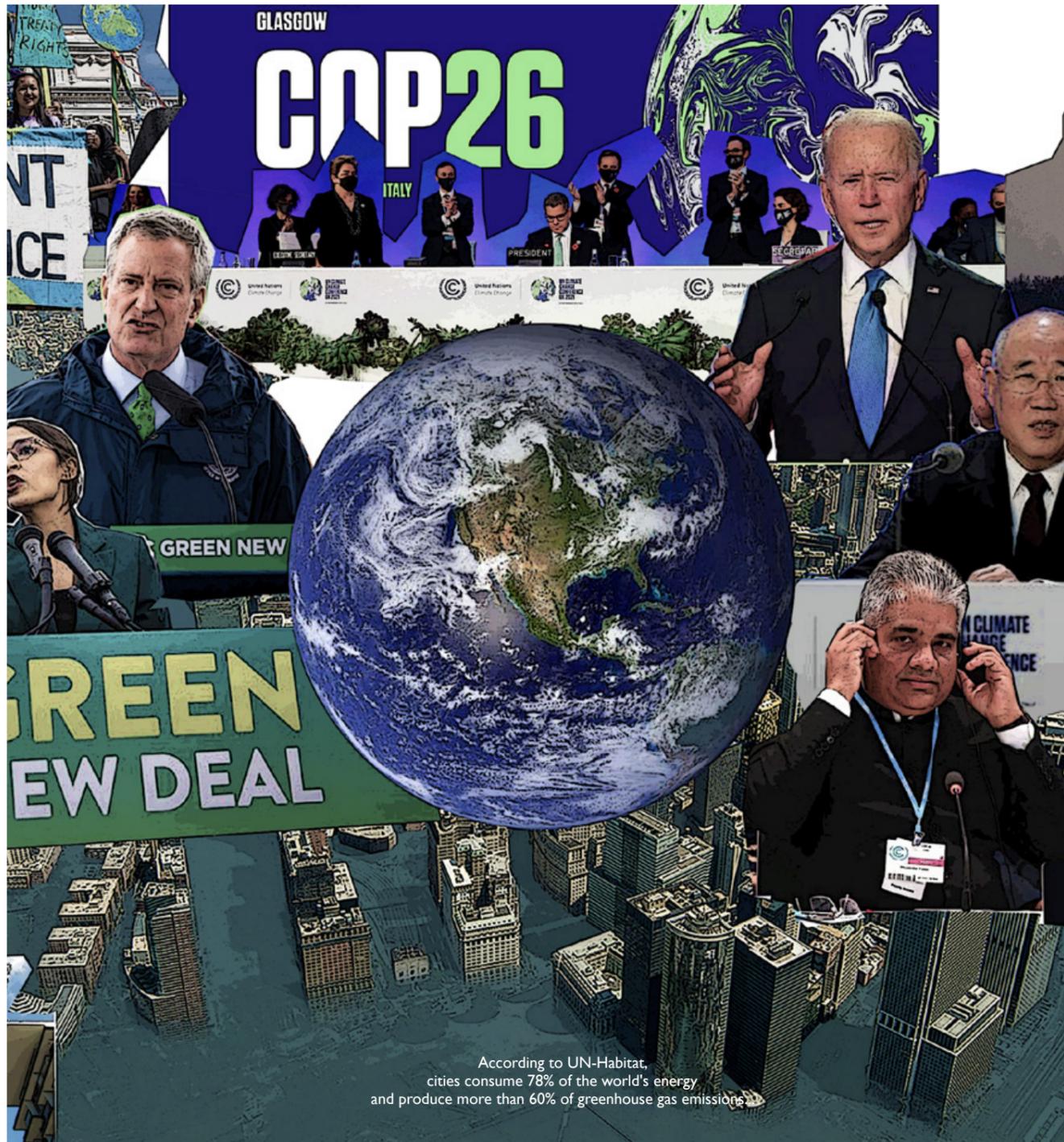
from City to Forest

*Site: New York City, United States
Sep.2021-Dec.2021*

*Academic work, Individual Work
GSAPP, Adv Studio V, 21Fall, Studio: Reset
Instructor: Prof. David Benjamin*

By installing this material that can accommodate plant growth on existing and new building facades, we can reduce building energy consumption through thermal insulation, which reduces energy for heating and cooling and improve the ecological environment of buildings and cities.

As these plants on the building surface continuously sequester carbon and as the product of carbon sequestration - fallen leaves - is recycled for energy production and jobs, a new urban eco-energy system will be built.



According to UN-Habitat, cities consume 78% of the world's energy and produce more than 60% of greenhouse gas emissions.

THE CLIMATE CRISIS AND THE GREEN NEW DEAL

According to UN-Habitat, cities consume 78% of global energy and produce 60% of global greenhouse gas emissions. At the same time, the fate of humanity has come to an important point in time. If we do not achieve net zero global carbon emissions in the next 10 years, we may lose our last chance to save ourselves.

For this reason, New York City has proposed the new green deal. Its main content is a bill that requires many of city's buildings to significantly reduce overall emissions by 40% by 2030. It makes the New York City the first city in the world to require all large existing buildings of 25,000 square feet or more - of which there are 50,000 citywide - to make energy efficiency upgrades to reduce energy use and emissions, or face stiff penalties.

At the same time, NYC CoolRoofs program promotes climate justice by prioritizing the installation of reflective roof coatings in New York City's most heat-vulnerable communities to help lower local temperatures and mitigate the health impacts of the urban heat island effect.

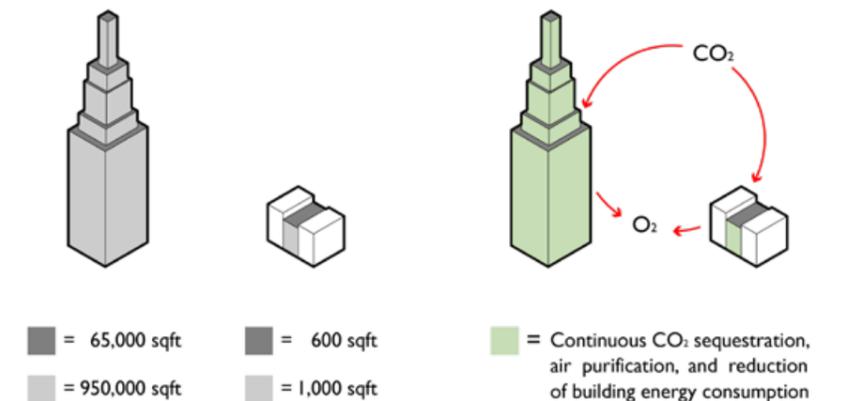


Volunteers with sustainable south bronx help paint a rooftop white at an nyc coolroofs project site.



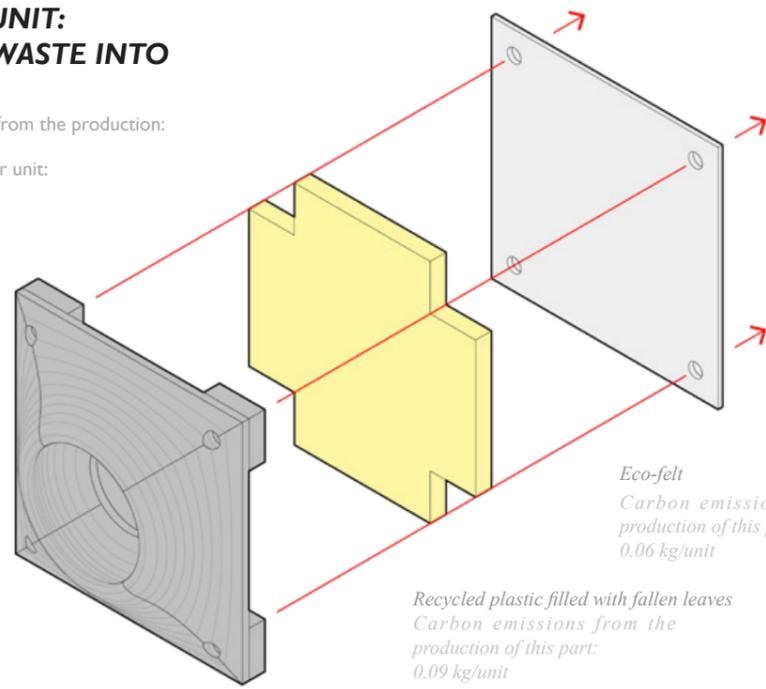
THOSE PARTS OF THE CITY THAT ARE NOT BEING UTILIZED

However, in addition to roofs, there is much more area of the building that is not being utilized, the façade. And if we don't just paint buildings into white, but use plants on the surface to continuously sequester carbon dioxide, perhaps cities can stop being the culprit of greenhouse gas emissions and instead act like a forest to continuously absorb carbon dioxide and improve our climate.



**MODULE UNIT:
TURNING WASTE INTO
TREASURE**

Carbon emissions from the production:
0.17 kg/unit
CO₂ absorption per unit:
0.15 kg/year



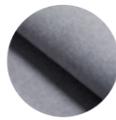
Waterproof layer
Carbon emissions from the production of this part:
0.02 kg/unit

Eco-felt
Carbon emissions from the production of this part:
0.06 kg/unit

Recycled plastic filled with fallen leaves
Carbon emissions from the production of this part:
0.09 kg/unit



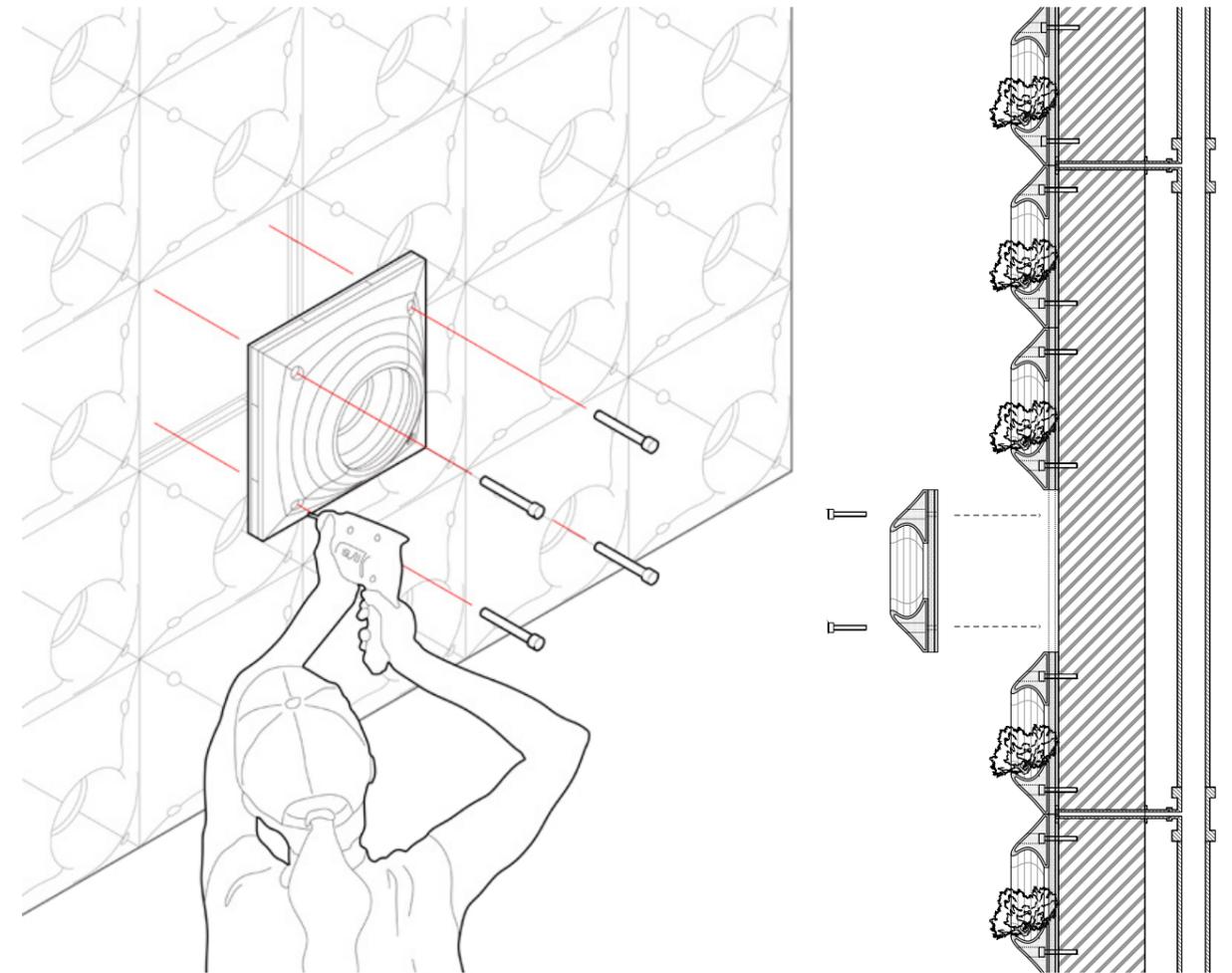
Fallen leaves are part of the ecological cycle in the forest, but in the city they are just seen as trash. However, when crushed, they can be fluffy and porous, allowing plants to take root like soil and providing insulation. The leaves can also be recycled for biogas generation, plywood production and composting.



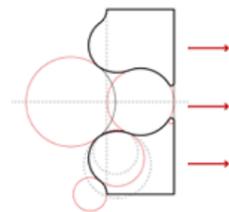
Eco-felt (formerly known as Eco-spun) is a polyester felt made from 100% post-consumer recycled plastic bottles (composed of PET). It takes 10 plastic bottles to make 1 pound of Eco-fi fiber. eco-fi felt is very breathable and absorbent.



Acrylic is a pure liquid, non-toxic, non-hazardous, non-flammable, open cap, soluble in water, easy to wall cracks combined to form a solid waterproof layer, performance characteristics are more stable, the application effect is more ideal.

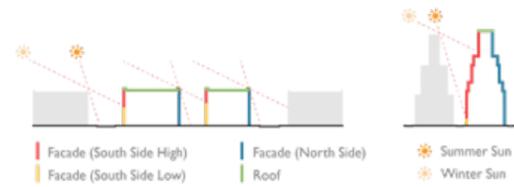


**FORM:
LIGHT AND VISUAL EFFECTS**

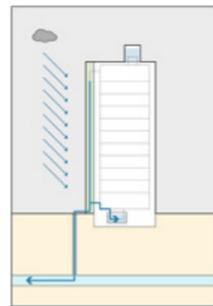


1. Space for plants to grow
2. Contains capillary fiber tubes to direct water and nutrient solution
3. Insulation layer to avoid damaging structural walls

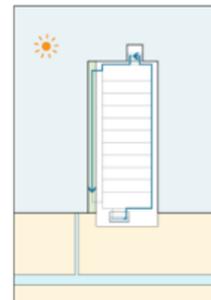
**COMBINED WITH ARCHITECTURE:
A DYNAMIC FAÇADE WATER SYSTEM**



Control the undulation of the material surface to control the shading that the plant can receive.

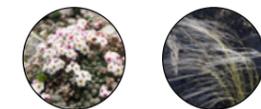
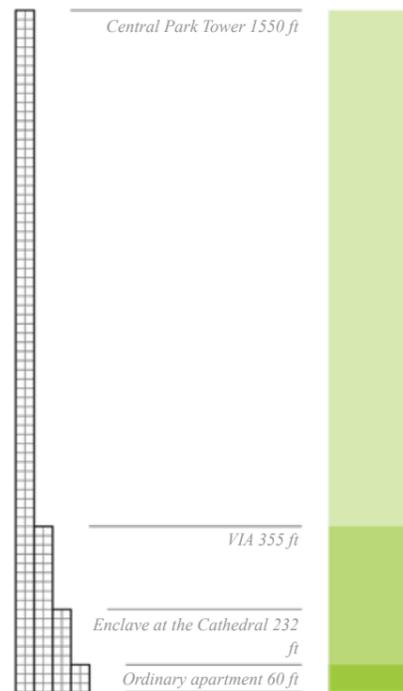


During heavy rainfall, some of the rainwater will be filtered and stored in the building, reducing urban sewer pressure and the potential for flooding.



On sunny days, water is supplied to the façade from the building, keeping a steady supply of water for the plants.

**STRATIFICATION IN HEIGHT:
ADAPTING TO CITY IN DIFFERENT HEIGHTS**



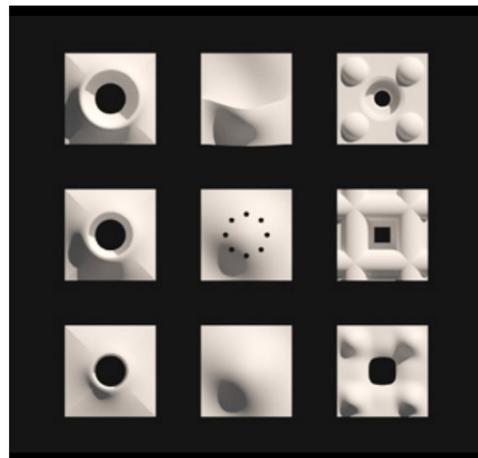
The height above 400ft is a high-rise space, where wind speed is faster and temperature is lower, making it more difficult to carry out regular maintenance, so plant some hardy and wind-resistant plants, such as matted plants and coneflowers.



The height of 80-400ft is the mid-level space, where people no longer have easy access to the façade, so some ferns, vine and etc. are mainly planted, and the annual harvest and maintenance are carried out by special personnel.



The height of 0-80ft is the low level space, where people can use the space of the building facade relatively easily (such as with the help of fire escape or balcony), so some vegetables can be grown in this height space.





CITY SYSTEM: WISER POLICIES, MORE JOBS, BETTER CITY



Empire State Building's estimated façade area: **82,300 m²**
Roughly **50 tons** of CO₂ per year.



New York apartment estimated street façade area: **90 m²**
Roughly **53 kilograms** of CO₂ per year.



4 LABOR
1 DAYS
1 BUILDING (100m²)
59 kg CO₂/year

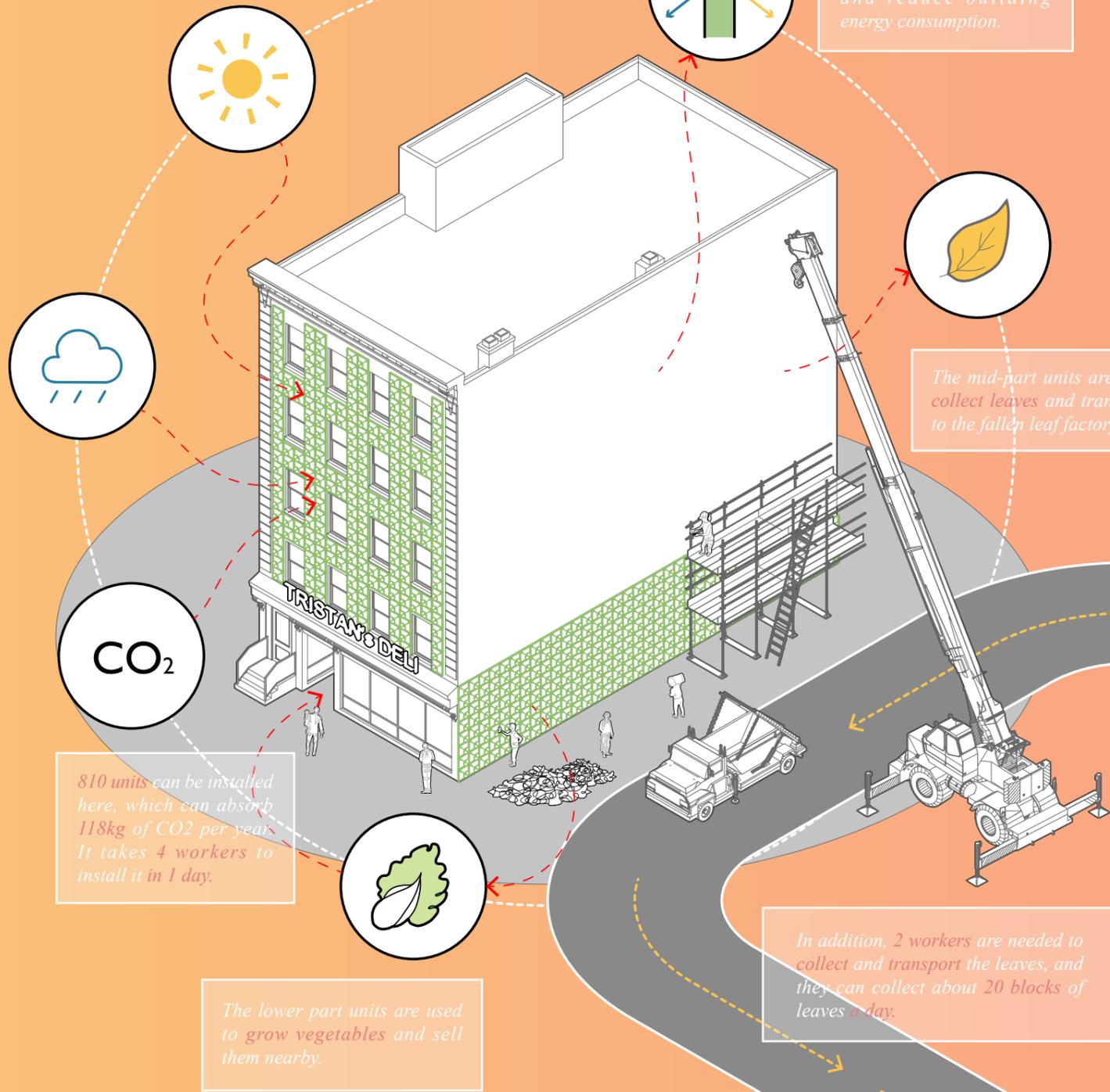
60 LABORS
1 WEEKS
1 BLOCKS
4130 kg CO₂/year

400 LABORS
1 YEAR
300 BLOCKS
1239 ton CO₂/year

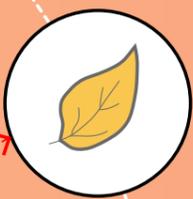
2000 LABORS
2 YEARS
1 MAHATTAN ISLAND
24597.1 ton CO₂/year
And help reduce building energy consumption by **20%-40%**



The building surfaces are used to receive sunlight, rainwater and CO₂, and are combined with the building water system to create a water cycle and balance.



All units can act as building thermal insulation and reduce building energy consumption.



The mid-part units are used to collect leaves and transported to the fallen leaf factory.

CO₂

810 units can be installed here, which can absorb 118kg of CO₂ per year. It takes 4 workers to install it in 1 day.



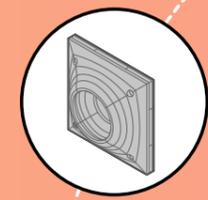
The lower part units are used to grow vegetables and sell them nearby.

In addition, 2 workers are needed to collect and transport the leaves, and they can collect about 20 blocks of leaves a day.

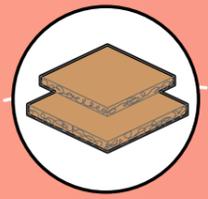
In the city, when the buildings are installed with these materials, they will produce vegetables and leaves like a running factory. The vegetables can be sold in nearby communities, providing local residents with fresh, organic vegetables and reducing carbon emissions from long-distance transportation.

A CIRCULAR URBAN SYSTEM WILL BE CONSTRUCTED

It takes about 288 people to collect all the leaves in Manhattan once, once a week for 3 months, and they can work with residents to collect and store and recycle.



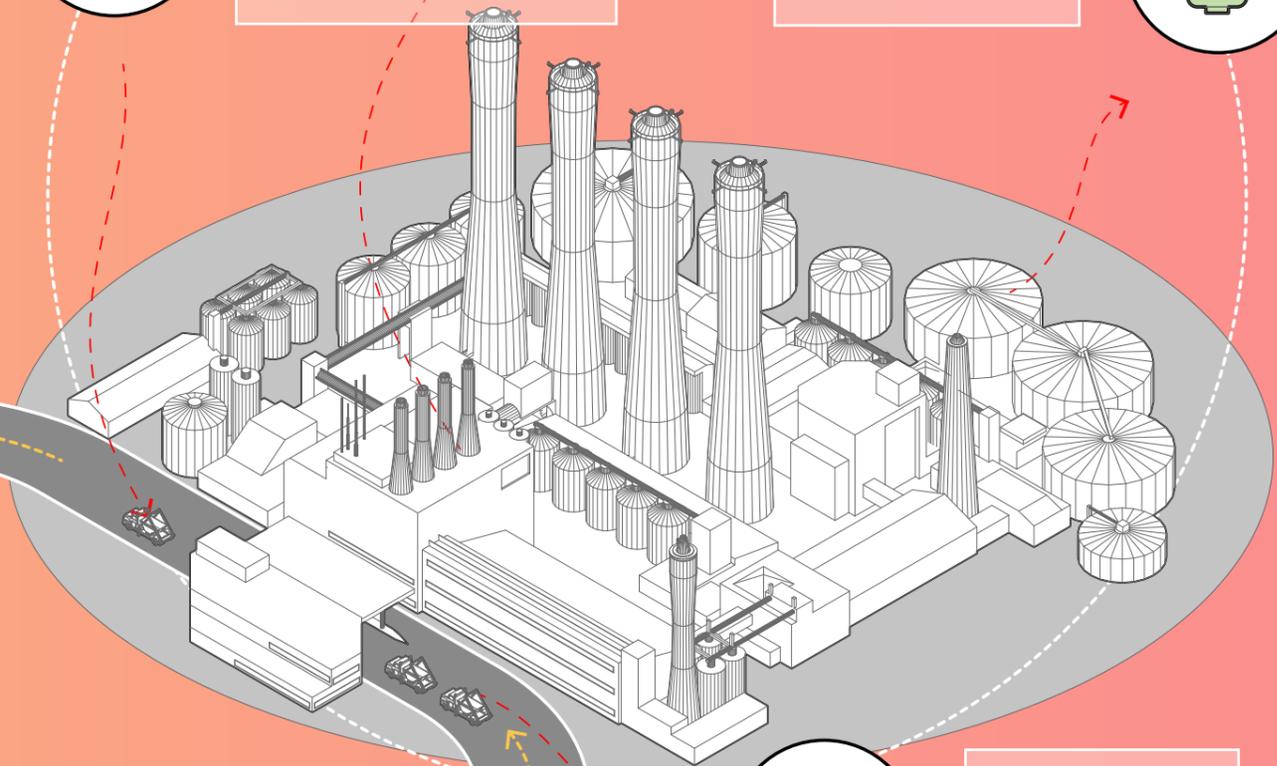
Some of them are crushed to make filler for the units, and the produced units are then transported back to the city for installation.



Part of them are used to make plywood, which can be used as raw material for furniture.



Part of them are used for Biogas generation to produce clean energy.



The leaves are transported to the leaf factory on the outskirts of the city.



Part of them are composted to produce fertilizer.

On the outskirts of the city, "Leaf Factory" will be built. Leaves from the city are recycled to the leaf factory via transportation team: part of the leaves are used to generate electricity through biogas (part of which feeds the transportation team), part is used to make plywood, part to produce fertilizer, and part to produce the units themselves.

ENERGY PARK

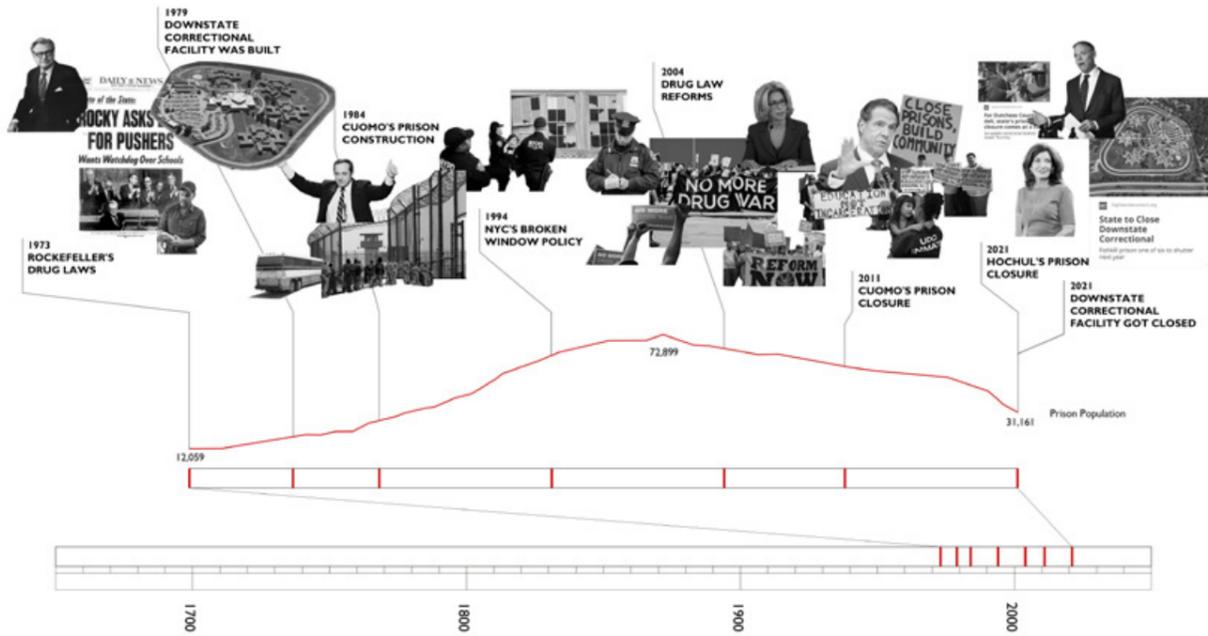
RESET THE PRISON

GSAPP, Adv Studio V, 22Spring
Studio: Prison

Site: Beacon, New York
Jan. 2022-Apr. 2022

Academic work, Individual Work
Instructor: Prof. Laura Kurgan





NEW YORK STATE PRISON CLOSURE HITS LOCAL AREA

Citing a decade-long decline in prison populations, the New York State Department of Corrections and Community Supervision has closed 26 prisons around the state. Included on this list as of March 10, 2022, Downstate Correctional Facility in Beacon will close along with 6 other prison closures this past year. The department said that all six closures will save the state about \$142 million.

BEACON IS SEEKING NEW OPPORTUNITIES FOR REVITALIZATION

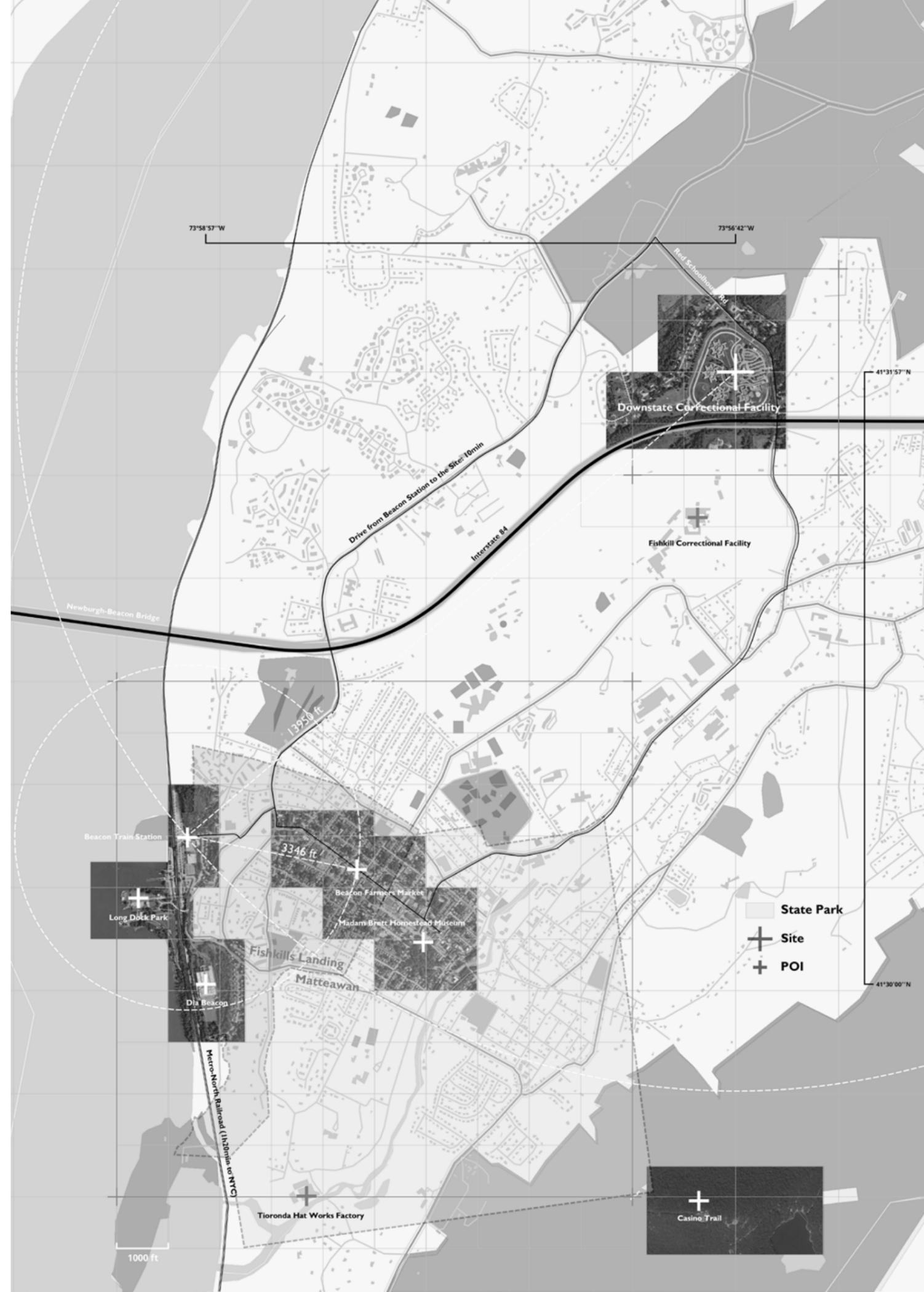
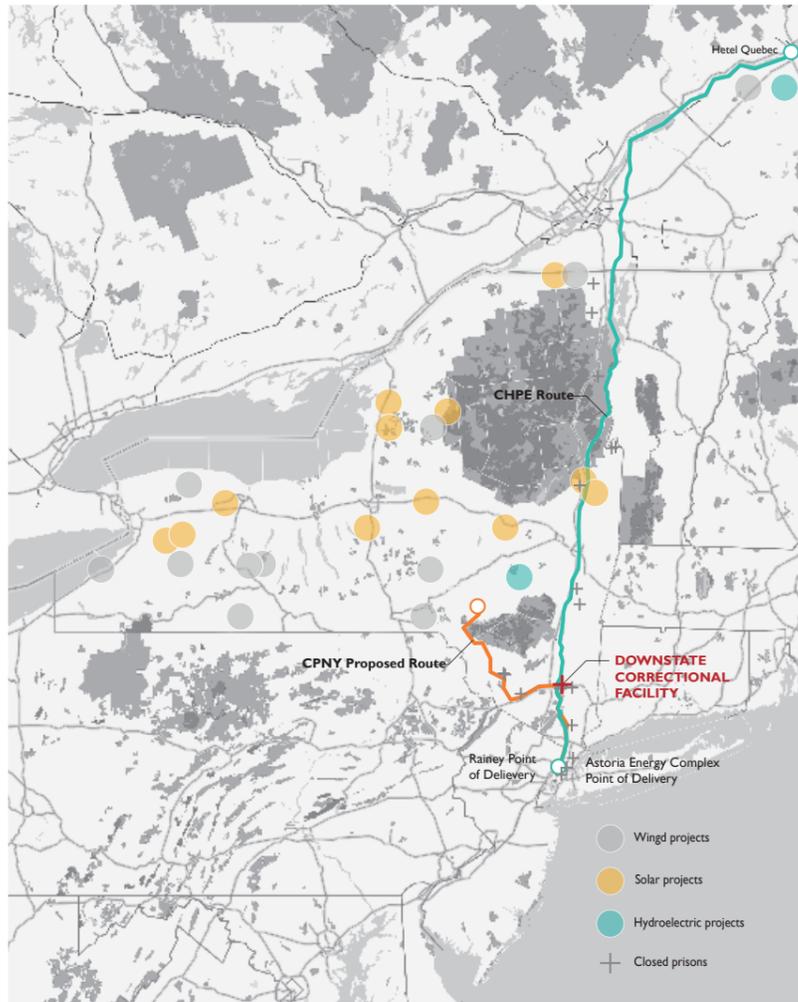
Beacon is a city located in Dutchess County, New York, which was once "the hat capital of the United States", and was very prosperous in the 1800s. But after the Great Depression, with the impact of foreign goods, Beacon was very depressed for a while, 80% of the factories and stores closed, and so it was no surprise that prison was located there. With the prison closure, what are the possibilities for new industries and development models that might revitalize this city?

THE DEVELOPMENT OF CLEAN ENERGY IS A GLOBAL TREND

As climate change becomes more severe, clean energy development is becoming a global trend. Biden signed an infrastructure bill in November 2021 with \$73 billion to invest in clean energy. In December 2021 the New York State government announced a framework for the State to achieve at least 10 gigawatts of distributed solar by 2030. And in September 2021, the State announced its intention to build two new transmission lines that will increase the amount of clean energy in New York City's grid, which will pass through the beacon.

Nov 15, 2021: The \$1 trillion infrastructure plan that President Joe Biden signed into law has money for roads, bridges, ports, rail transit, safe water, the power grid, broadband internet and more.

Mar 22, 2022: New York State leaders celebrated the milestone of 1 GW of community solar installed, the most of any state in the U.S.





BREAKING DOWN THE DEHUMANIZING SCALE

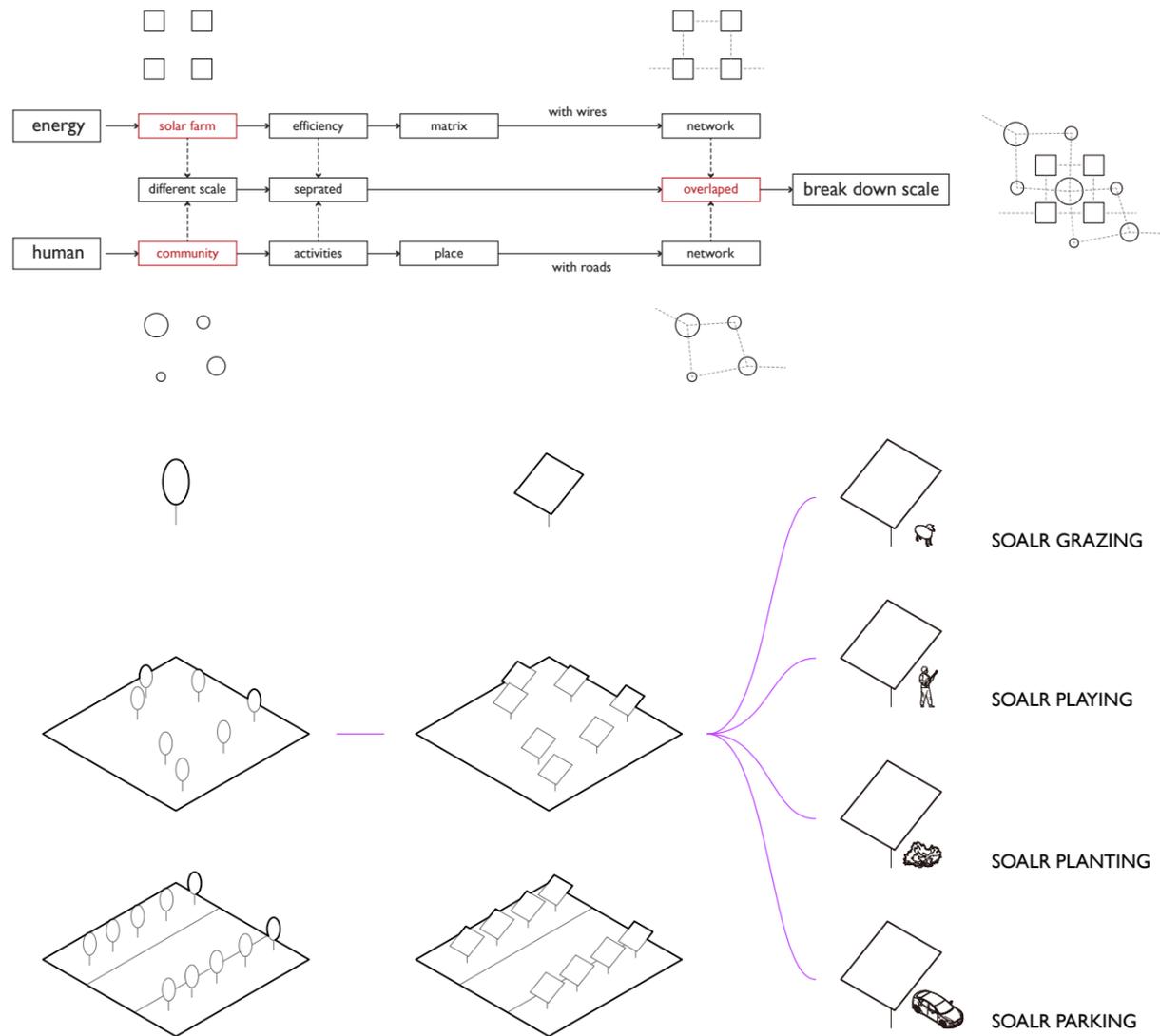
FROM FOSSIL ENERGY TO CLEAN ENERGY, IS ENERGY STILL TO BE SEPARATED FROM COMMUNITIES?

Therefore, the energy industry seems to be a feasible new industry for Beacon. In the past, traditional energy systems were often far from cities due to the distribution of minerals, pollution from mining, and large amounts of equipment, and they were as much an exostructure as a prison. But new clean energy sources, such as solar, are much freer in location and production, it seems like we can install them anywhere without too

much equipment. As we progress from fossil energy systems to new clean energy systems, will our cities, communities, and lifestyles remain the same as before? Will we still have to keep the energy as energy and communities as communities? Or can we embrace a new way of lifestyle in a more coexistent way?

THE BIGGEST PROBLEM: DIFFERENT GOALS LEAD TO DIFFERENT SCALES

The answer is not that simple; to achieve high efficiency, clean energy projects are often produced on huge scales with no attention to the local community close to them. My project tries to avoid this by creating a coexisting lifestyle and breaking down the dehumanizing scale of energy projects by overlapping the two different networks of energy projects and communities.

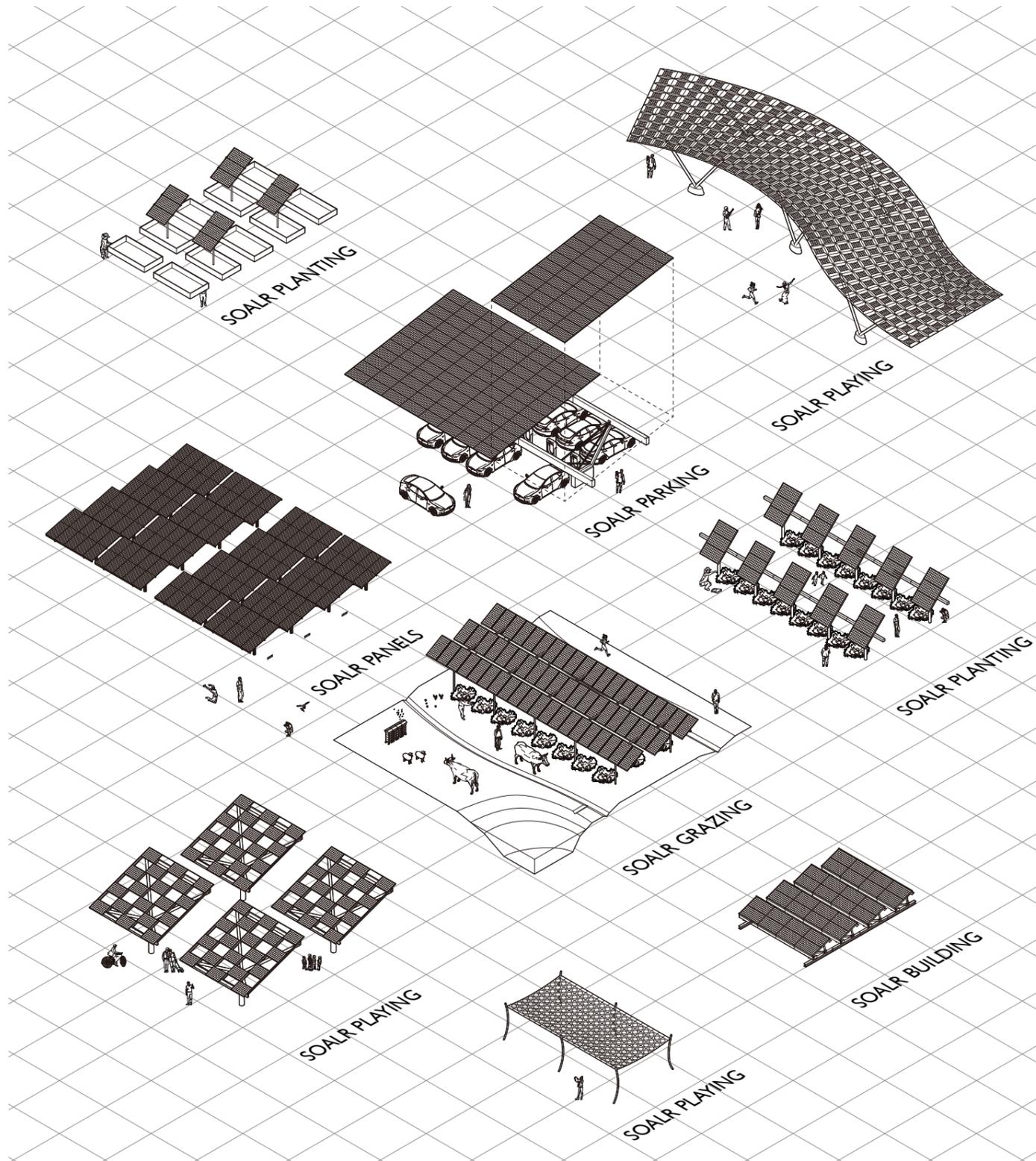


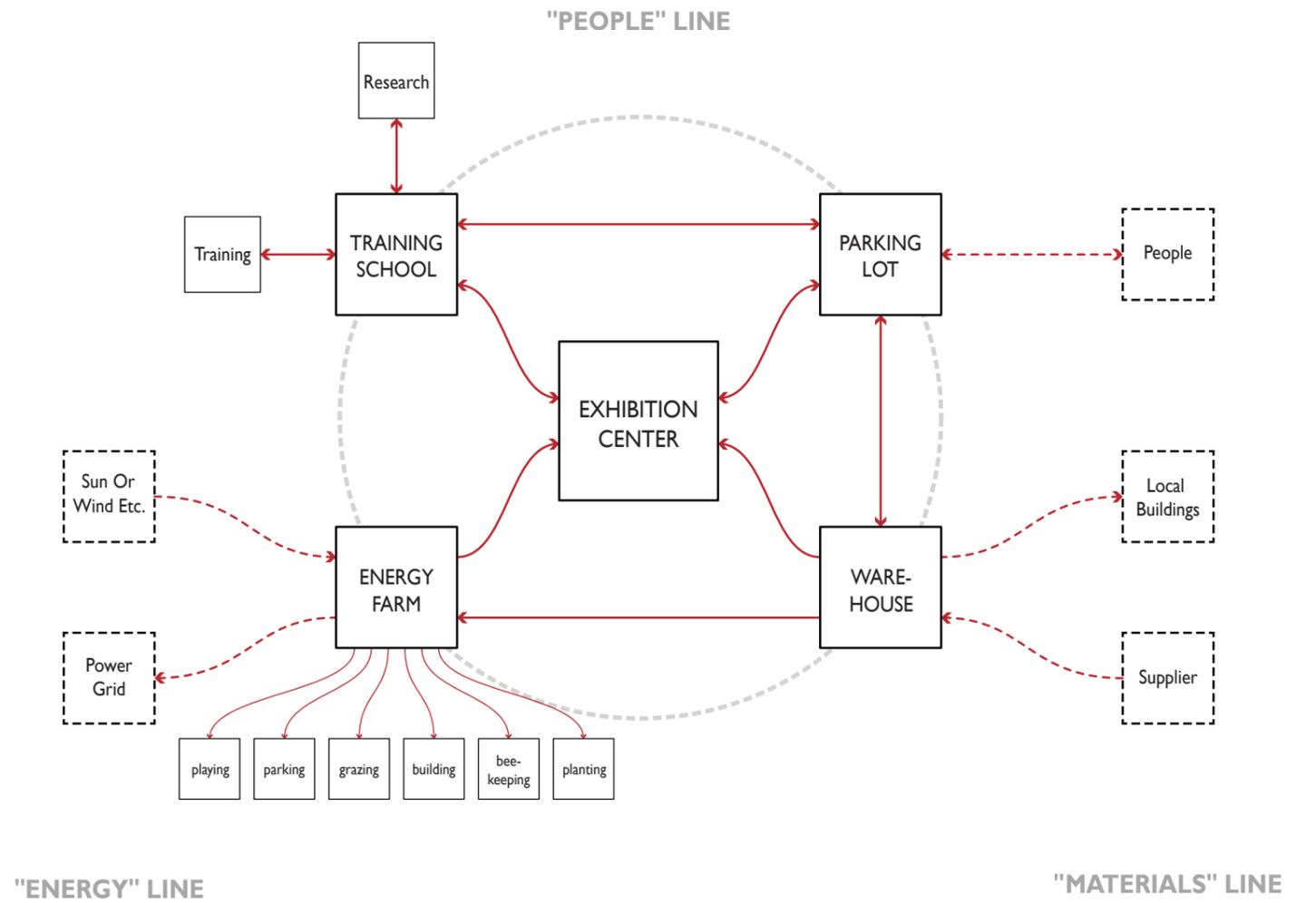
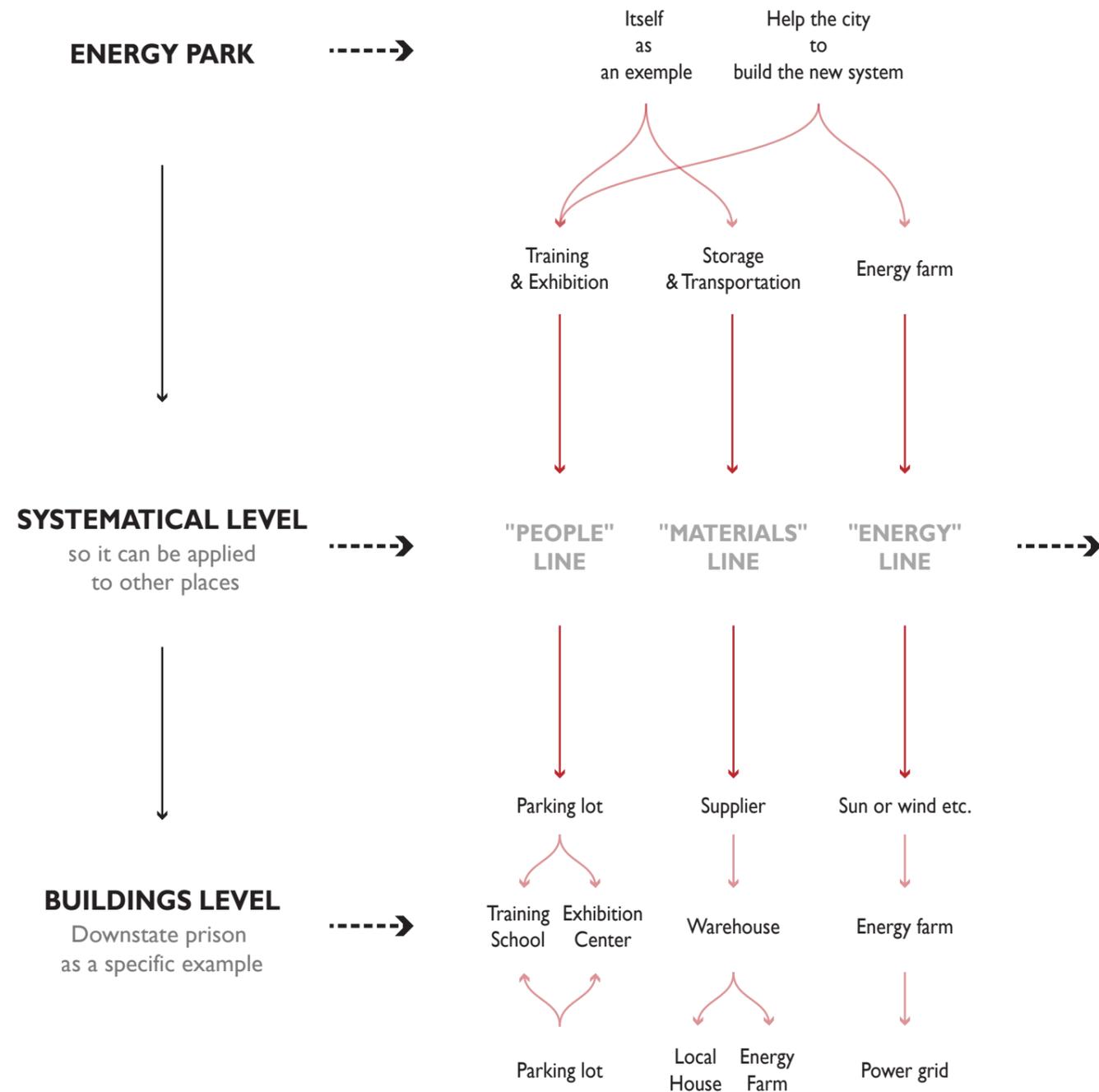
A COMMUNITY-BASED FORM OF ENERGY LANDSCAPE?

And at the same time, the spatial features of the solar panel create multiple possibilities. The upper structure absorbs energy, and the lower part provides a supporting and connecting structure.

Despite supporting the upper panels, the lower structure creates a lot of inhabitable space. In a way, its structure is similar to most plants, a classic landscape element. So is it possible for solar panels

to catalyze a new landscape element for a new era?





SPACE & FUNCTION RESEARCH

During the transformation from energy equipment into landscape elements, the former prison provides an excellent site. Due to its former function, the prison is already equipped to transport and store large amounts of goods. And its geographic proximity to the city center ensures that it maintains its connection to the city while having relatively cheap land prices. And what does an energy landscape park need? First, this new type of energy park needs to

respond to three things: the flow of energy, the flow of materials, and the flow of people. These three flows establish the functional and spatial needs of this project. And second, a very important function of this new energy project I am designing is to educate the public, I used a centripetal spatial pattern of the prison, to create an exhibition center (which used to be the prison's main building), while the different types of solar farms are located outside the exhibition

center as "exhibits". And also we have a training school here to train the local laborers to become the solar installers to help build the new energy system in Beacon, you can see this park is not the destination but a starting point.

1. Tourist & Exhibition Center
2. Central Lawn
3. Training & Research Center
4. Farm & Food Production
5. Energy Storage & Warehouse
6. Solar Fields
7. Solar Parking
8. Community Sports courts
9. Public Square
10. Main entrance
11. Grazing lawn
12. flower lawn



I-84

Redschoolhouse Rd

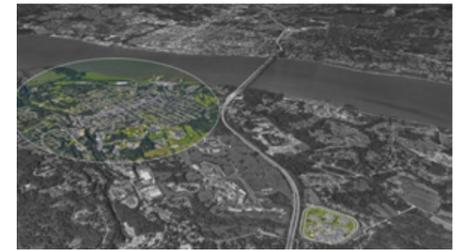
- Pond & Swale
- Woods
- Lawn
- Trail
- Pavement



THE ADVANTAGES OF TRANSFORMING A PRISON INTO AN ENERGY PARK

LOCATION

It's usually near the city but not too close so that easy to get the materials required but has a cheap land price



TRANSPORTATION

It's usually close to the highway to easily transport large scale products that prisoners need and prisoners

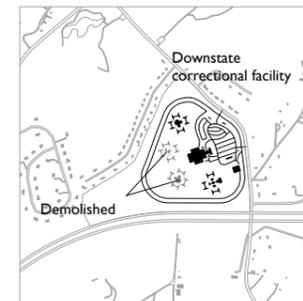


LAYOUT

It's usually equipped with lots of empty space and facilities such as a large parking lot and warehouse



LAYOUT GENERATION



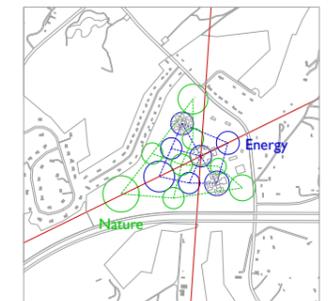
Step 1

Based on this model, the original main building became the exhibition center and also the visitor center. Two buildings were demolished to create space for a centralized solar farm.



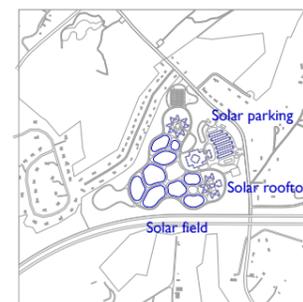
Step 2

Two main axes are created for traffic and landscape respectively.



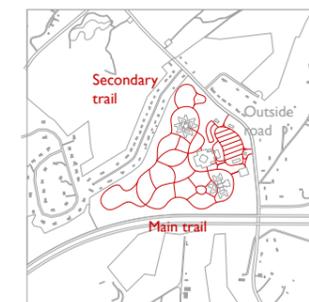
Step 3

The two axes establish the hierarchy of space and landscape.



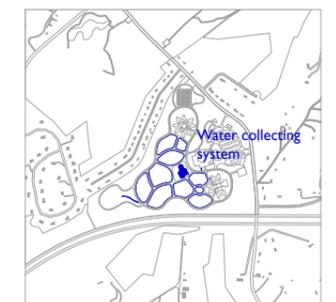
Step 4

The solar field, the parking lot, and the building form the network of energy as different types of solar combinations.



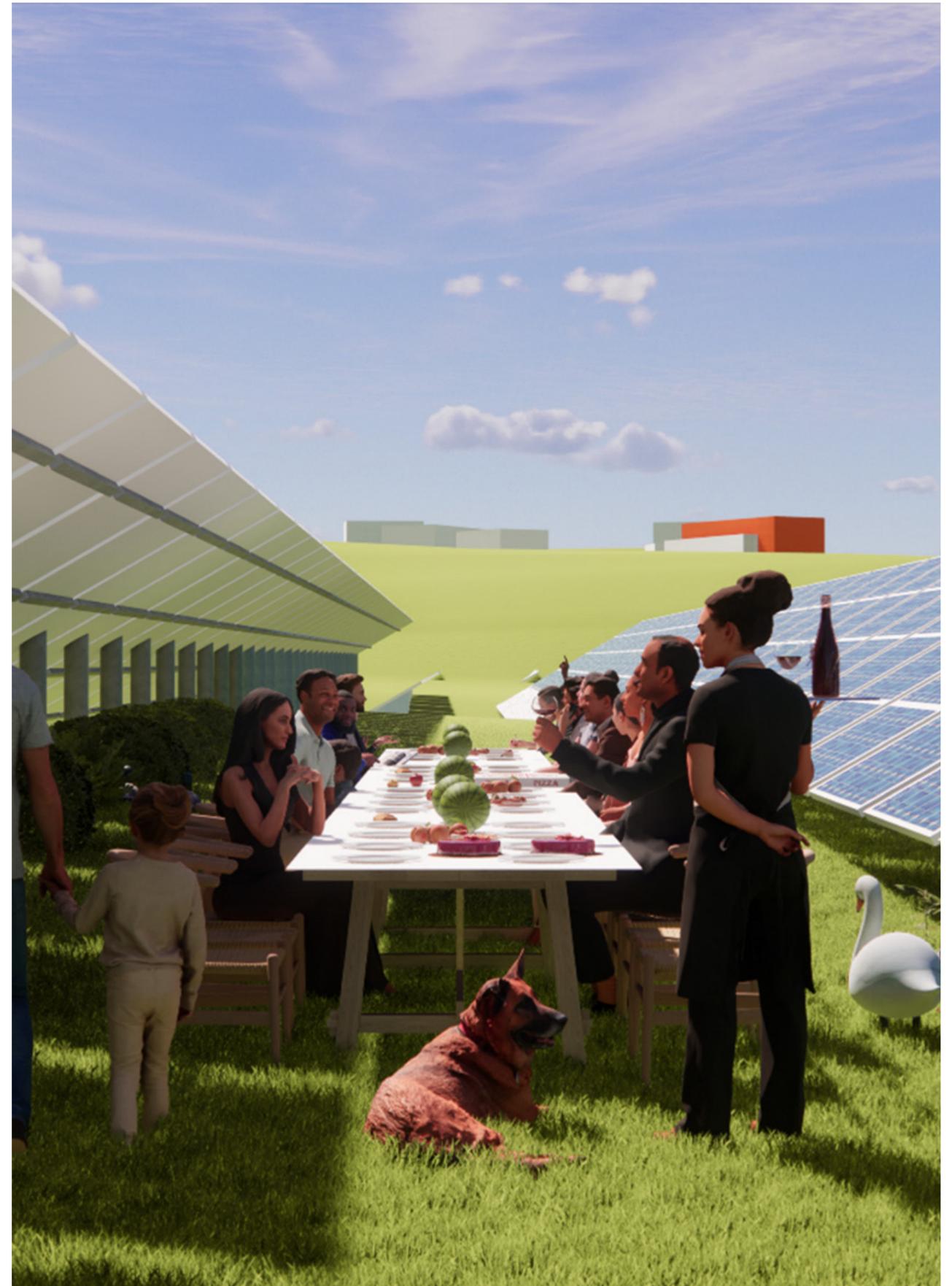
Step 5

Roads and public spaces form the network of the community breaking down the dehumanizing scale of the solar farm.



Step 6

Water, plants, and solar panels as common landscape elements create a new landscape product.



Solar playing: The park is open to the public, with a large lawn and sports fields, it is not just an energy factory, but a community energy park. Local people can come here and have their family party during the weekend. And it will also be counted as one of the amazing attractions of Beacon and attract more tourists here.



Farm Animals



White-tailed deer



Raccoon



Sheep



Cow



Bee



Long-tailed weasel



Owl



The eastern bluebird



Hen



Goose



Duck



Squirrel



Farm Plants



Red Maple



Green Ash



Red Chokeberry



Switch Grass



Kale



Beet



Carrot



Tomato



Pine Tree



Black Willow



Butterfly Weed



Smooth Alder



Lettuce



Squash

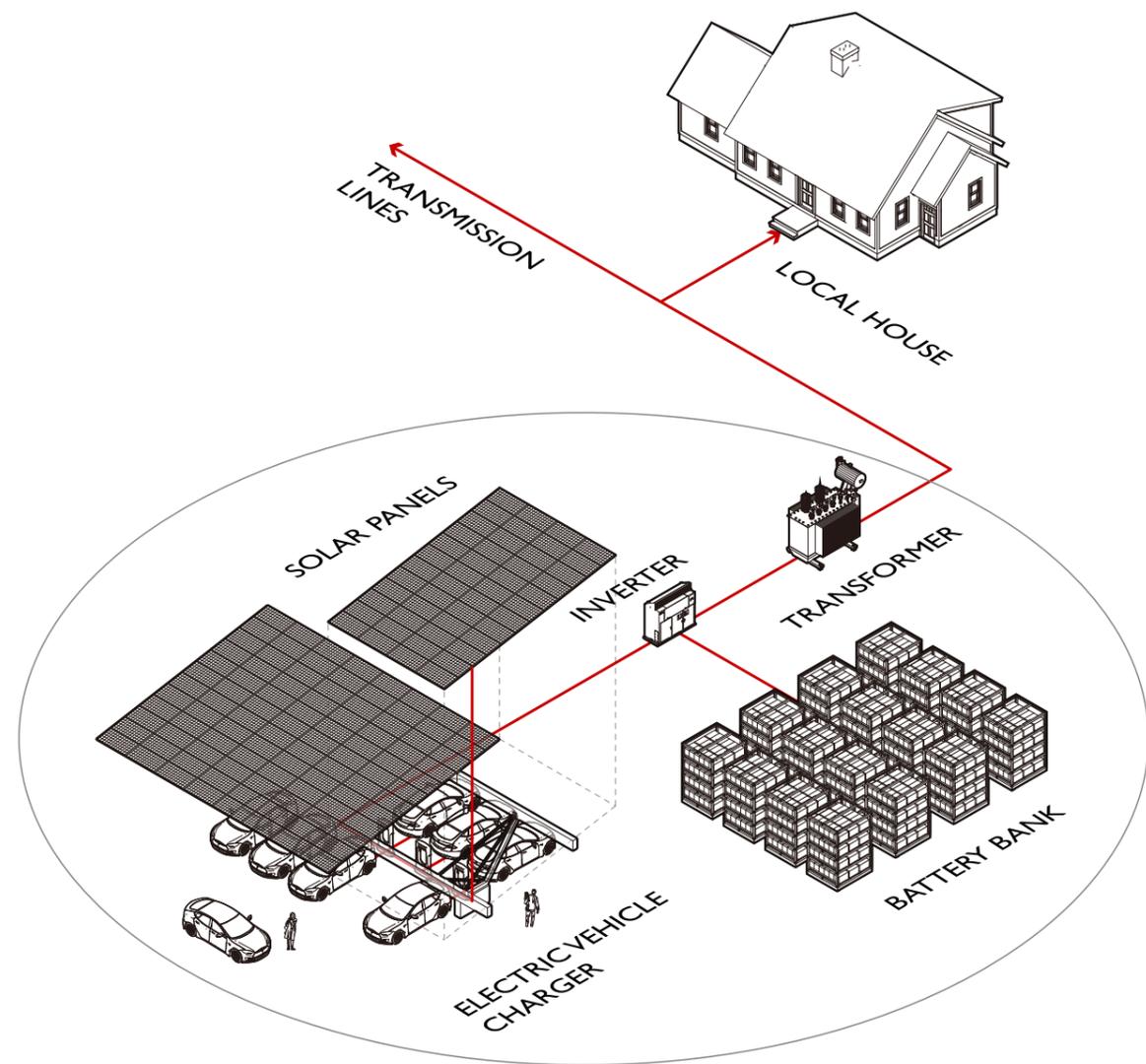


Turnip



Grapevine

Solar planting & grazing: The solar field becomes a new type of farm, people can work and picnic in the field while harvesting both food and energy, where crops can be grown and animals raised under solar panels, and the research shows that with the solar panels shading plants in an appropriate way, they can even grow better through reducing the evapotranspiration.



THE ENERGY PARK HAS A **4.5 MW** SOLAR POWER PLANT
 SUPPLY ELECTRICITY TO **738 FAMILIES** PER YEAR
 HELP REDUCE CO₂ EMISSIONS BY **19.19 TONS** PER YEAR

Solar parking: The parking lot provides shade and becomes a charging station for electric vehicles. And more than that, all the electricity produced by solar panels will be stored or supplied to the local

families or even sold to the other cities.

In the future, this energy park will meet the electricity needs of 738 households per year and

provide the freshest food to the local area, which helps us to reduce nearly 20 tons of CO₂ emissions per year. It's not just a new energy plant, it's a new way of life.





03

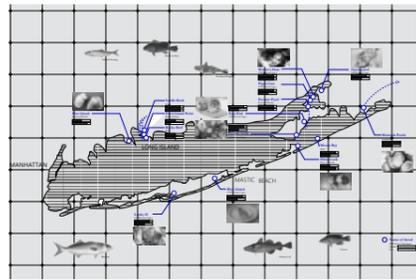
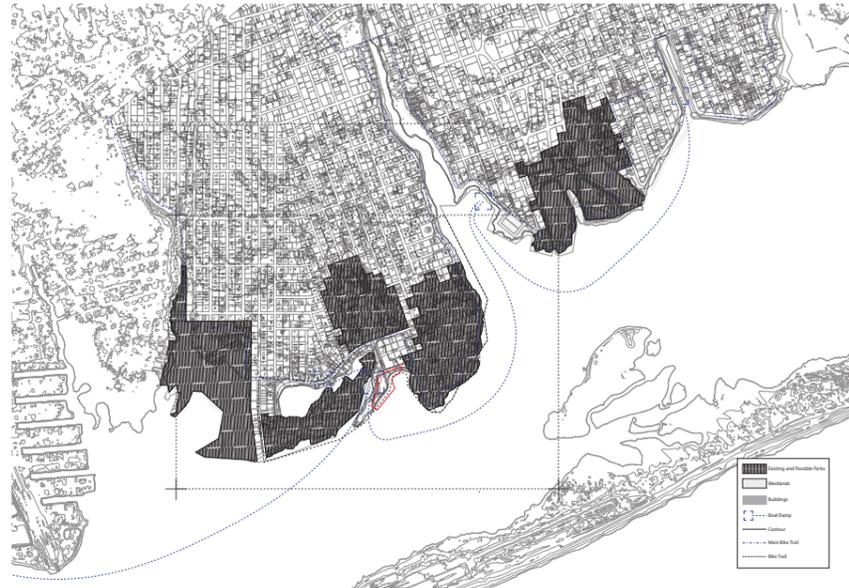
LAND BUOY

from Buoy to Restaurant

*Site: Long Island, United States
June.2021-Aug.2021*

*Academic work
Partner: Qiwei Sun
GSAPP, Adv Studio V, 21Summer, Studio: Beach Lab
Instructor: Prof. Tei Carpenter*

...
Witness the ocean giving us food and taking it away
Witness the sea receding to reveal the land and flooding it again
Witness the sea evaporating into rain and then falling into the land
Witness the past, present and future
Witness human changing nature
Witness nature changing human
Witness the cycle
Witness the connection
...



SITE

The Mastic beach is located in the middle of the famous long island. It takes about 2 hours to get there from Manhattan.

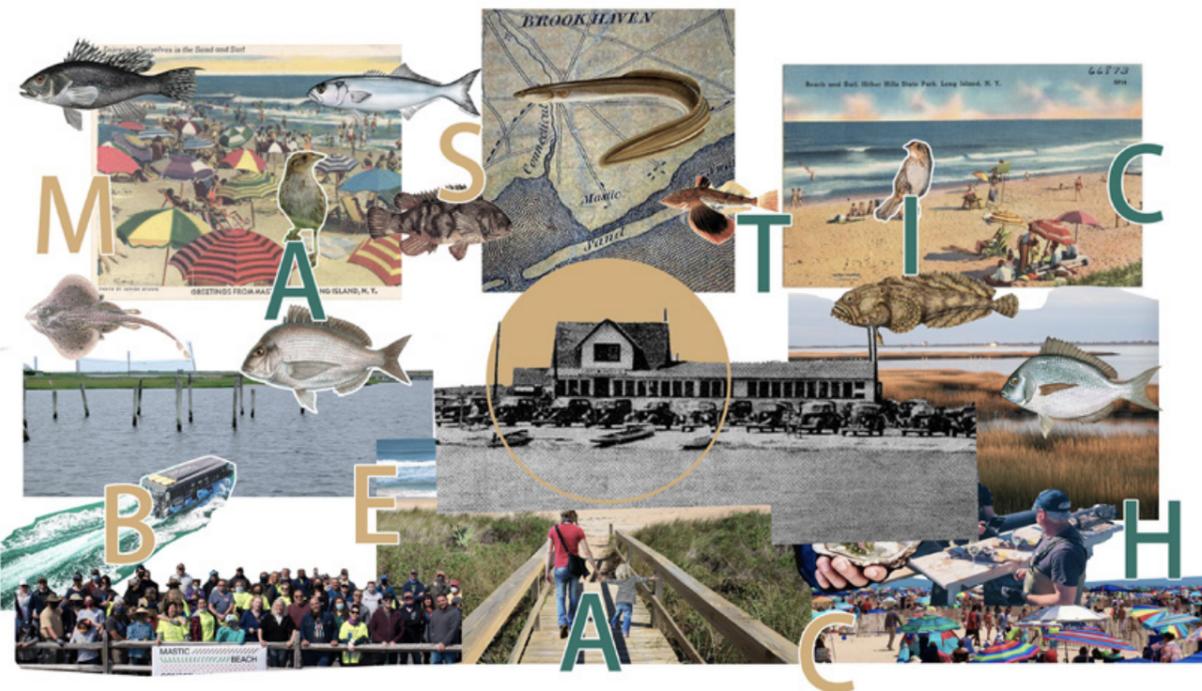
There is various kinds of marine animals, including fish, oyster and scallops, with different flavors, all around the mastic beach.

NATURAL RESOURCES

The violet's cove is surrounded by a series of wetlands, high marsh and intertidal marsh, existing and possible parks, boat ramps and marinas. There is also an suggested long bike trail along the seashore and passes near the Violet's cove. And the site is an important knot linking to all the resources.

CLIMATE CHANGE & FLOOD

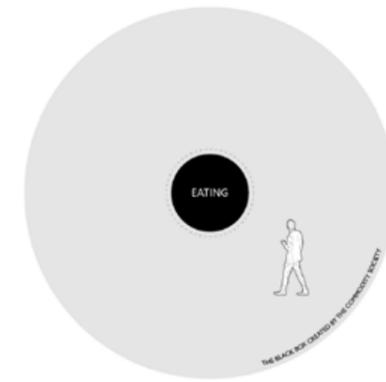
Although there are plenty of natural resources, the site has been long suffering from occasional flooding, which cause huge inconvenience, as you can see in the pictures and the problem is to pertuate. In fact, the sea level is rising gradually, and is expected to inundate most of the lands of the Mastic beach in decades.



COMMUNITY & HISTORY

However, what especially touched us is the cohesion and resilience of the community. Despite all the problems, people in the Mastic Beach kept positive towards life, thus we feel we have to do something for them. Mastic beach has excellent natural resources and people loves it, yet it is a pearl buried in the sand that is not fully appreciated by others. There used to be a restaurant in the area, and after it closed down, it became a food desert, so both locals and foreign visitors are eagerly awaiting a new restaurant.

At the same time, frequent floods make it impossible to ignore climate change any longer. We thought we needed to do more than just design a restaurant, we saw this restaurant as an opportunity to create a closer connection between people and nature through "eating".



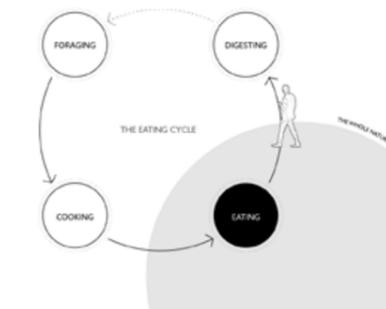
PEOPLE

THE EATING CYCLE

In modern society, food is beautifully packaged and presented on the table, thus many people don't care where their food comes from and where it goes.

So we want to provide a series of activities about food that make up the eating cycle, through which "eating" becomes a way for people to perceive their connection to nature.

To us, the "eating" should be about the whole process of getting food from the nature to the table and back to nature. We hope that when people come to the restaurant, they don't just fill their bellies, but to learn more about their food. Only then will they know what kind of diet is healthier and eco-friendly.

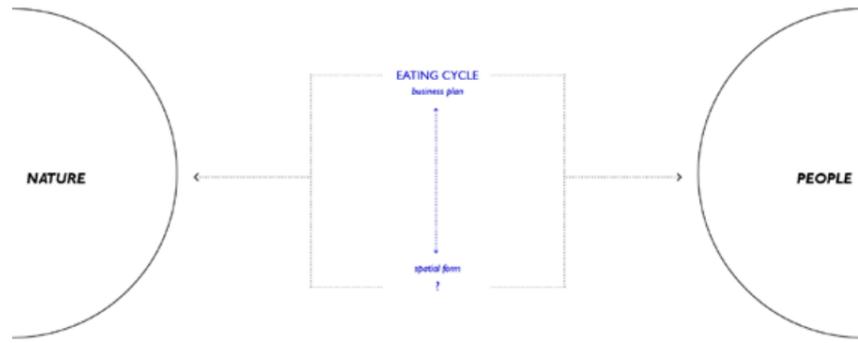


NATURE

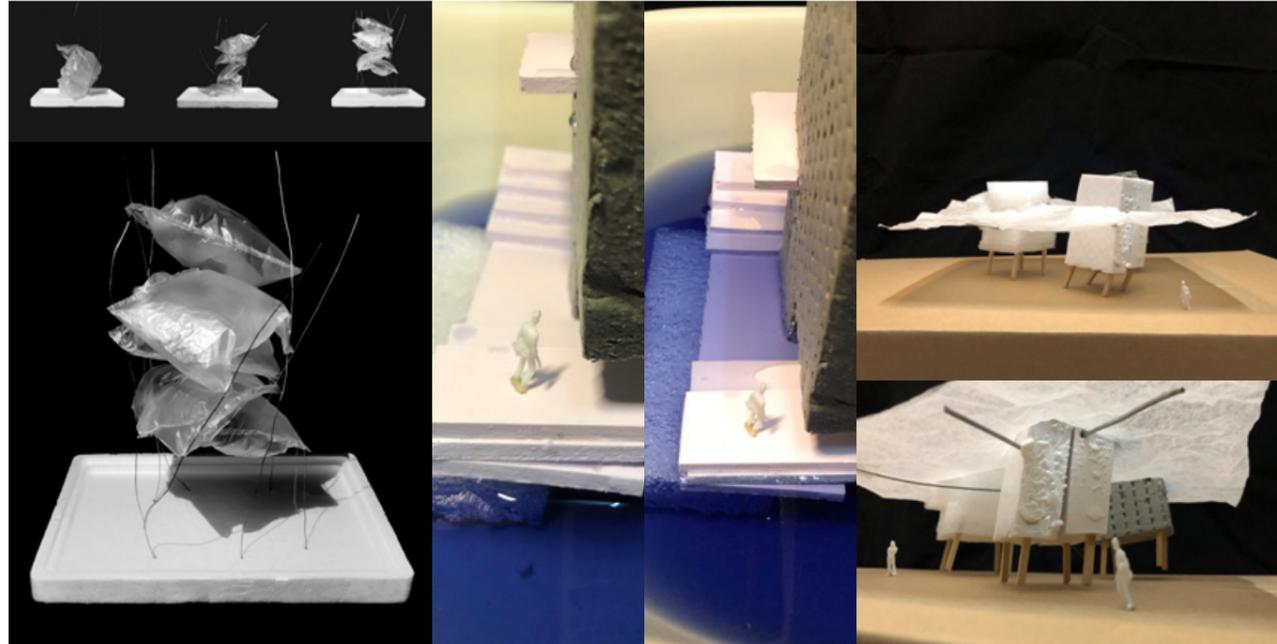


LAND BUOY

We wanted to create a closer connection between people and nature through a series of activities related to food, and so do the design forms and spatial relationships.



STUDY MODEL: PHASE I

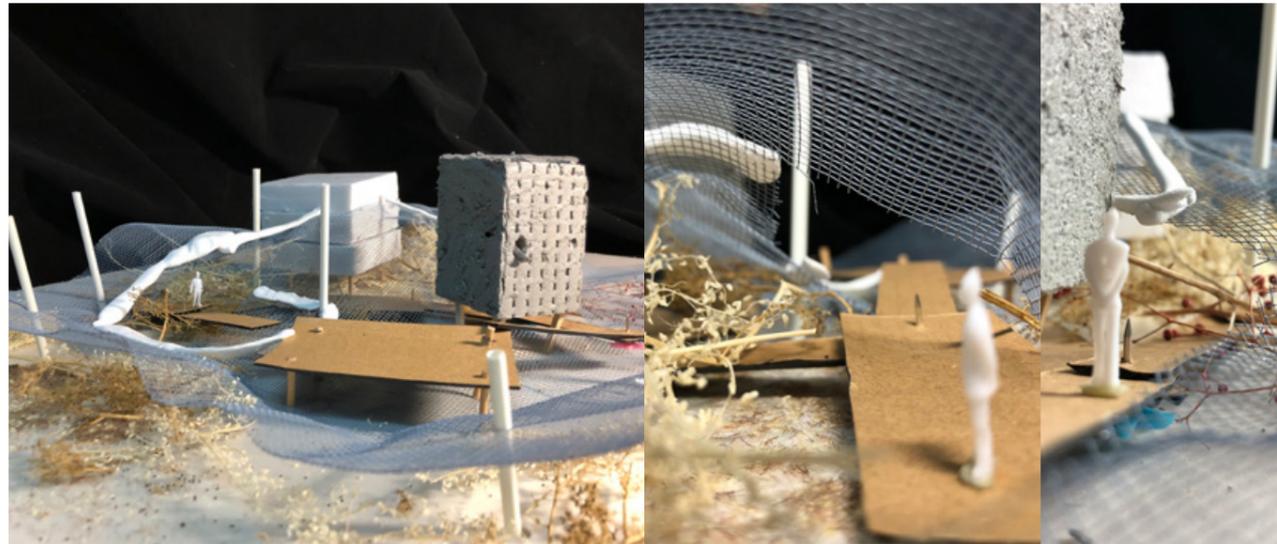


Option 1
"Tied Pillar"

Option 2
"Rising Level"

Option 3
"Floating House"

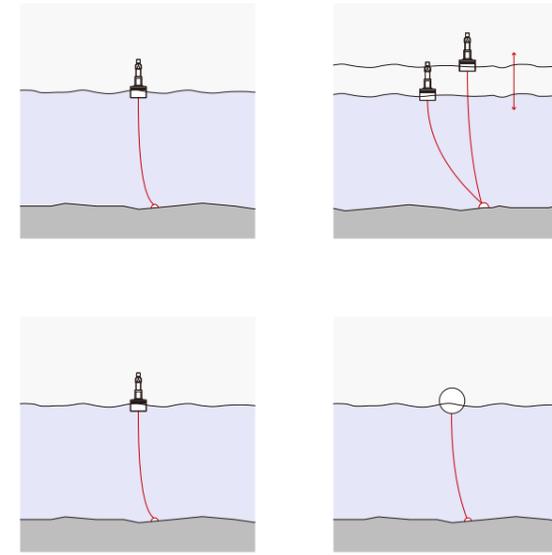
STUDY MODEL: PHASE II



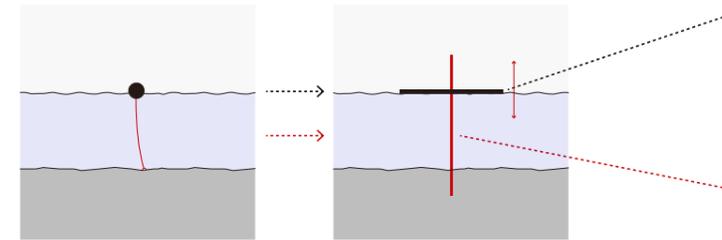
So we did lots of case studies. And we discovered buoy, and the very interesting relationship behind it. The buoy can float on the sea and change with the ebb and flow of the sea, while at the same time it is fixed on the ground. This relationship makes the buoy a mediator between the ground and the

sea, it creates a connection between them. We also found interesting elements in the site. Like the stakes and elevated houses. Inspired by these relationships, we made some models to further investigate the relationship between the sea and

the ground. Finally, we simplified these spatial patterns to get the prototype of Land buoy, which is a translation of the spatial relationship represented by the traditional buoy.

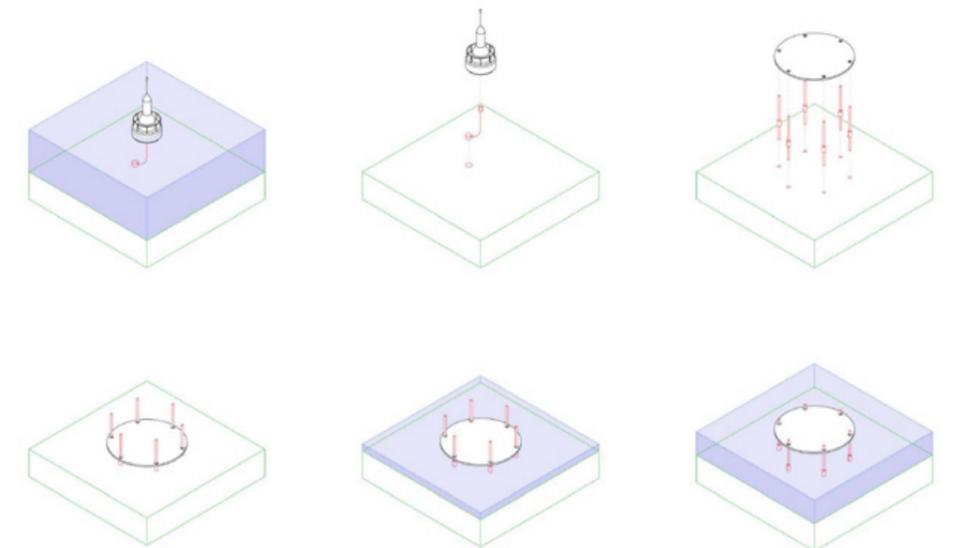


BUOY



LAND BUOY

BUOY TRANSLATION



RISE WITH THE SEA

We translate the main body floating on the sea and the chains anchoring buoy to the sea bed into platform and pillar. The platform can move up and down along the pillar.



ELEMENTS IN THE SITE





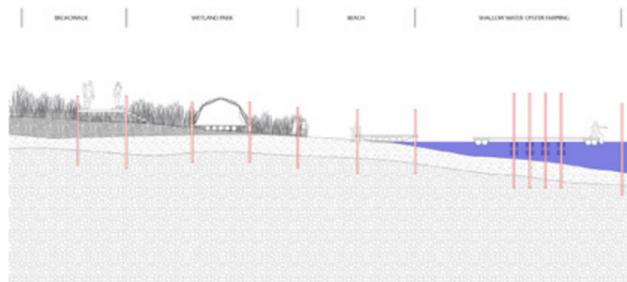
LAND BUOY DISTRIBUTION

The landbuoy prototype evolves into 10 different types depending on the different activities in the eating cycle. The site is also divided into 3 areas, one for water-related activities, one for vegetable cultivation and related ecological education, and one for landpark, which will be transformed into a

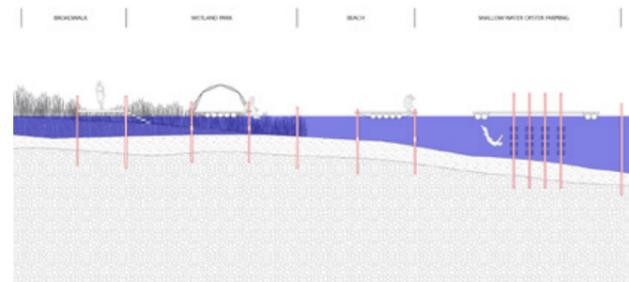
wetland landscape park through ecological restoration. All landbuoys will be connected by a set of roads and walkways.



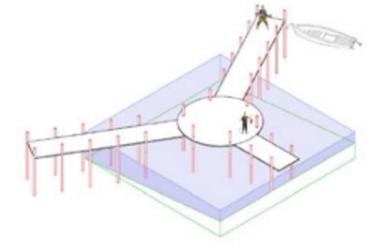
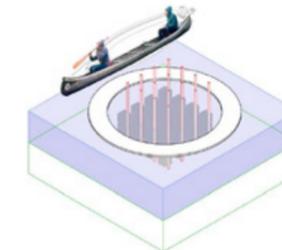
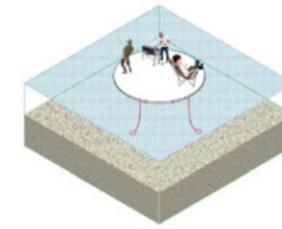
These roads and landbuoys are designed to ensure continued use in the event of flooding.



The land buoy is erected on the site through the pillar, thus reducing the impact of the building on the surface ecosystem.

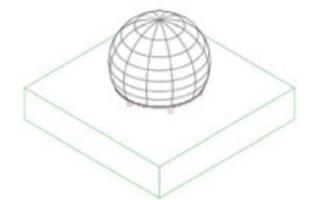
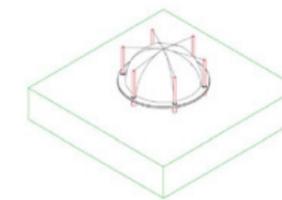
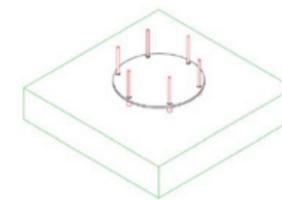


When the ground is submerged due to rising seawater, the platform can float on the water surface and thus continue to be used.



BUOYTYPE I: SEA

All of these landbuoys can be divided into four categories, the first being water-related activities such as sunbathing, fishing, and learning about oyster farming.



BUOYTYPE II: LAND

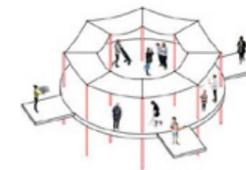
The second type is related to land activities, including camping, vegetable gardening, etc.



THEATER BUOY



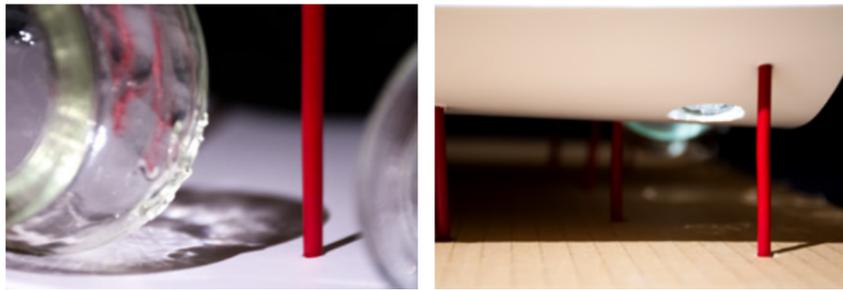
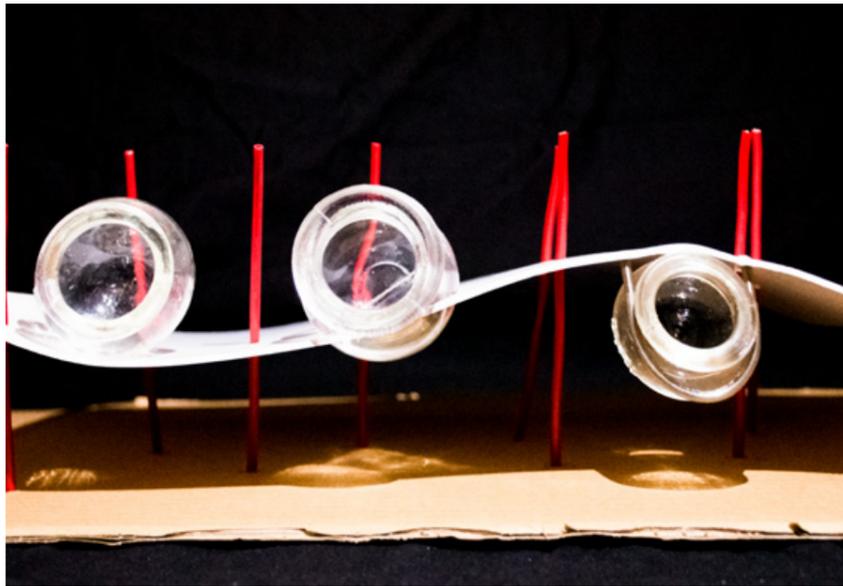
LAND-SEA PLAZA BUOY



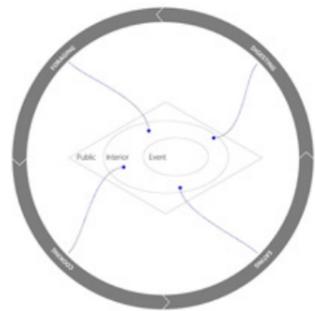
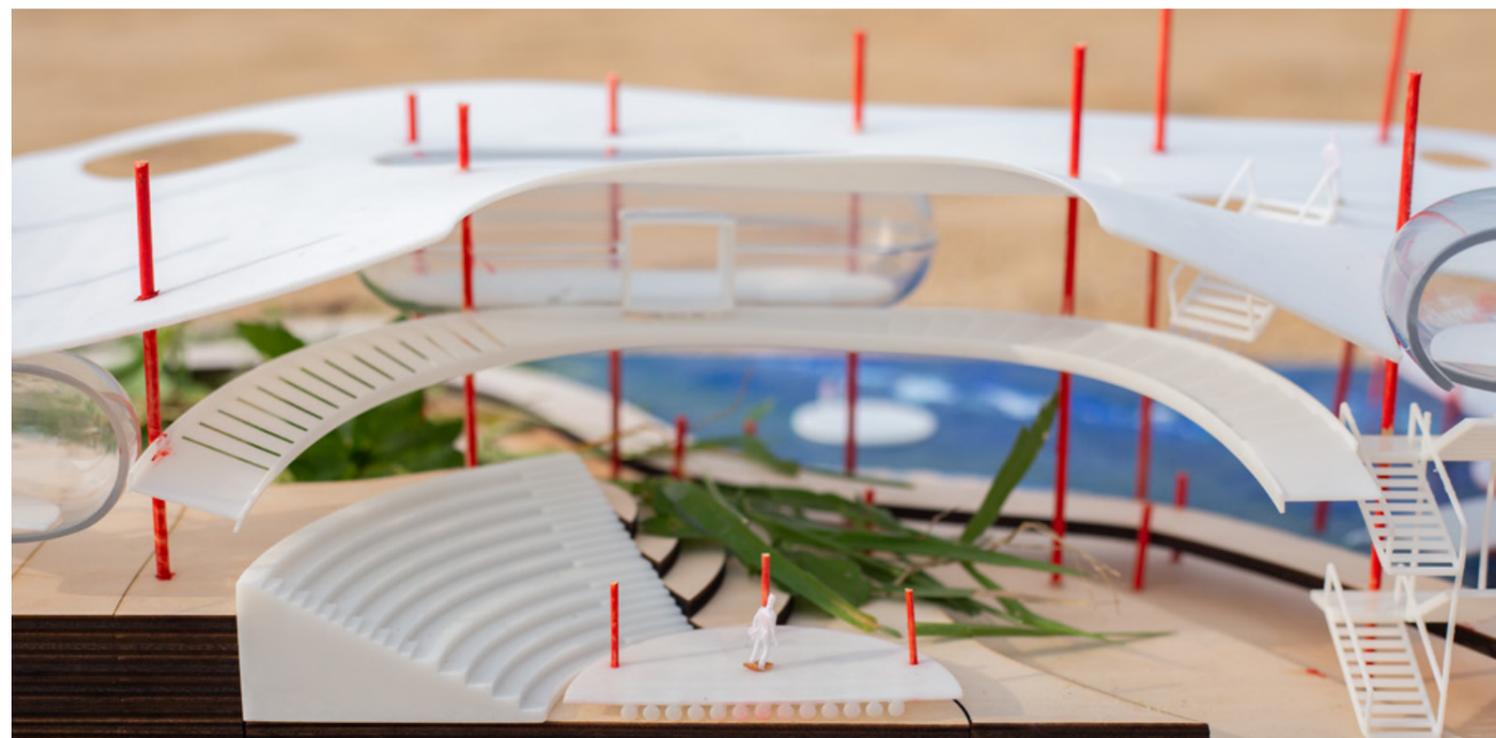
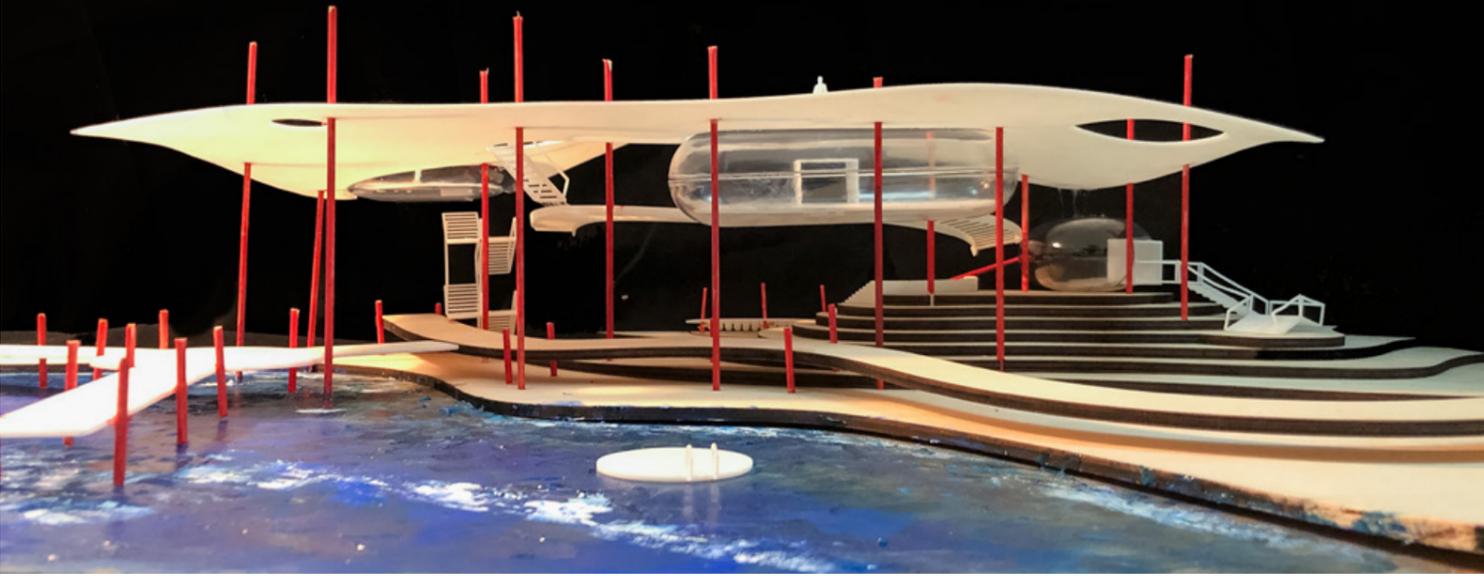
BROADWAY NODE BUOY

BUOYTYPE III: PUBLIC

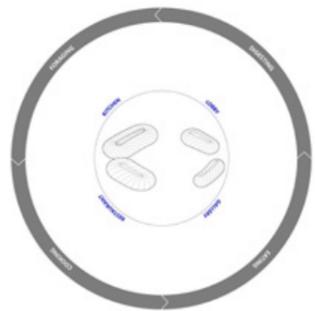
The third type is related to public activities.



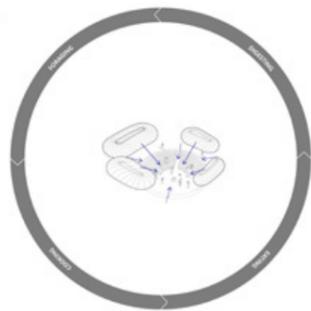
STUDY MODEL: PHASE III



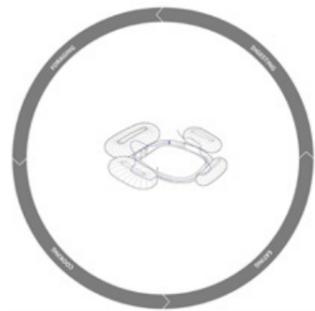
Step 1
All steps of the Eating Cycle, including Foraging, Cooking, Eating, Digesting can be implemented in a ring inside the complex buoy.



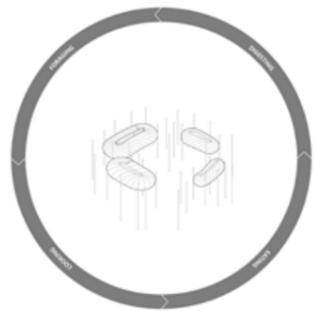
Step 2
The ring of enclosed space is then divided into four parts defined as lobby, gallery, kitchen and restaurant.



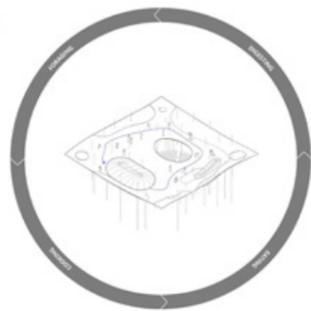
Step 3
Surrounding the center theater, which is an event space.



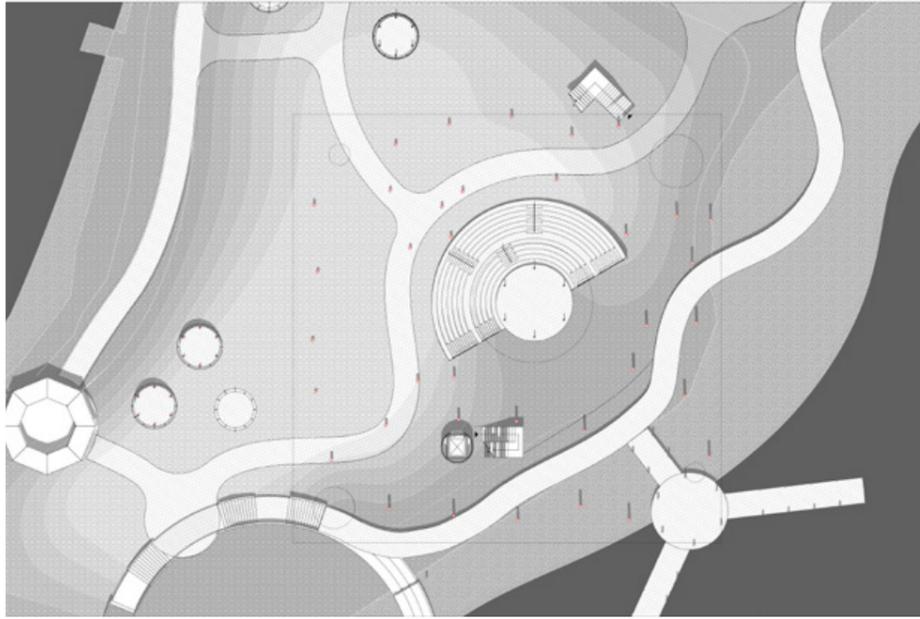
Step 4
And interconnected by a corridor where the cycle take place,



Step 5
Finally there is the roof, supported by the system of pillars...

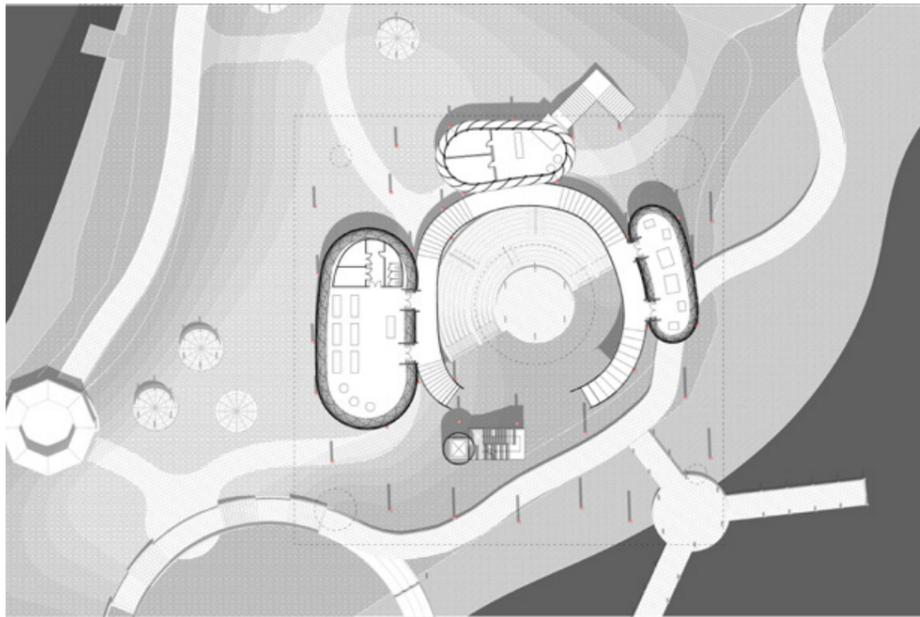


Step 6
...covering the enclosures and provide a new activity space and landscape on the top



THEATER & MARINA

Since it takes two hours ride from New York City, people may come here a little before noon, and start an unforgettable day. Then you can have a general view of the fascinating natural environment. Also you can have a view of the birds landing on the stakes as well as the oyster farming in the water.

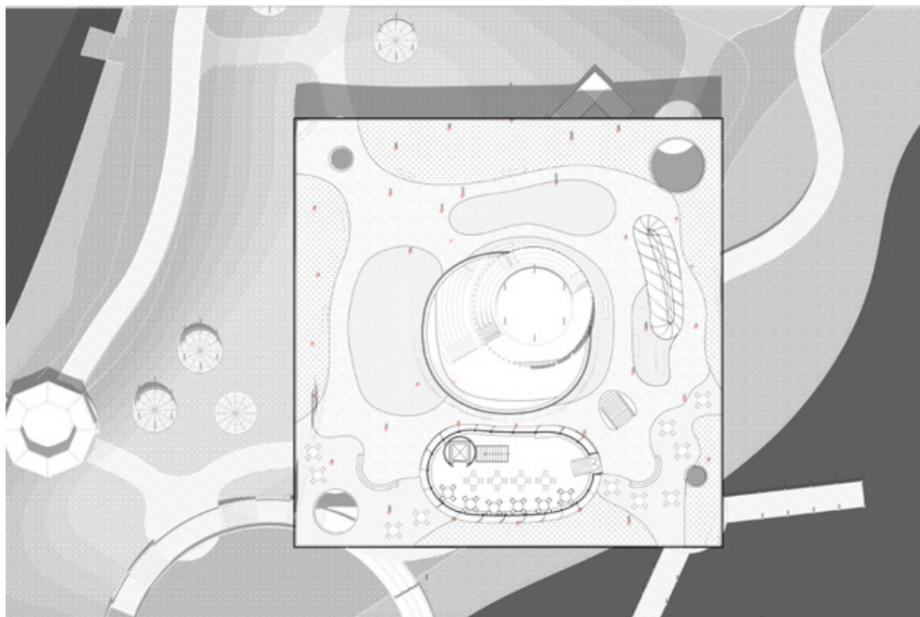


WORKSHOP KITCHEN & GALLERY

After you finished foraging around the site, maybe around noon, and come back with all the seafood, you may get interested in how to cook them well.

Then you can get to the complex buoy with your trophies and learn how to cook by attending the cooking workshop in the kitchen.

Then excitedly you come to the restaurant to enjoy your featured meal. You can also choose to have takeaway foods so you can enjoy the food wherever you want.



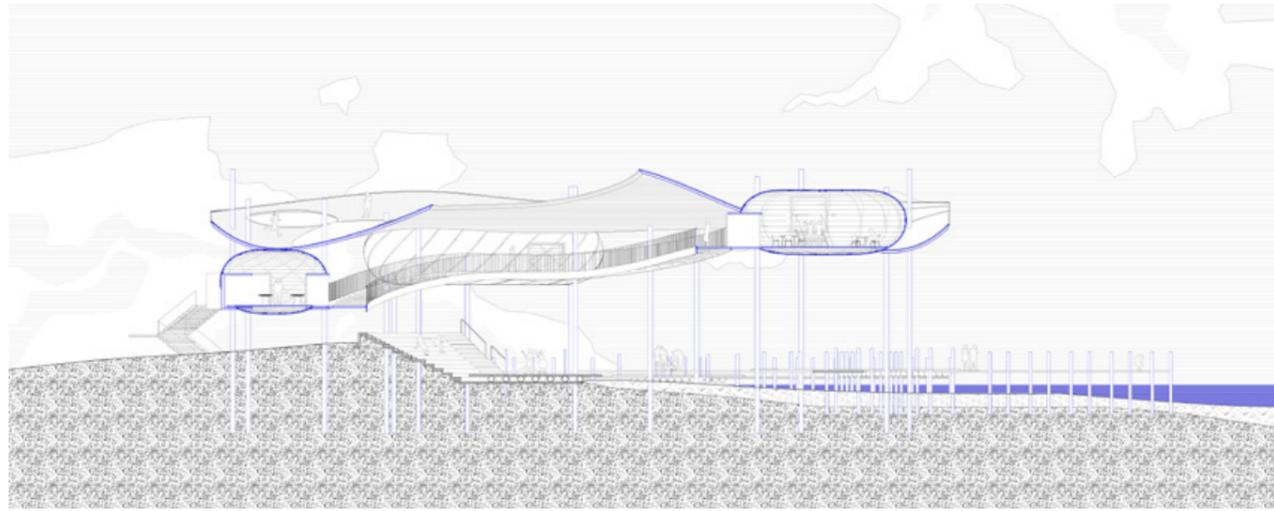
RESTAURANT & ROOFTOP

The restaurant also have access to the rooftop. The roof is an elevated platform in a curved shape and where you can have meals outdoors, or have a look at the rooftop plantings, having a view of the sea, or just spending some time having fun on the terrace walking through the pillars



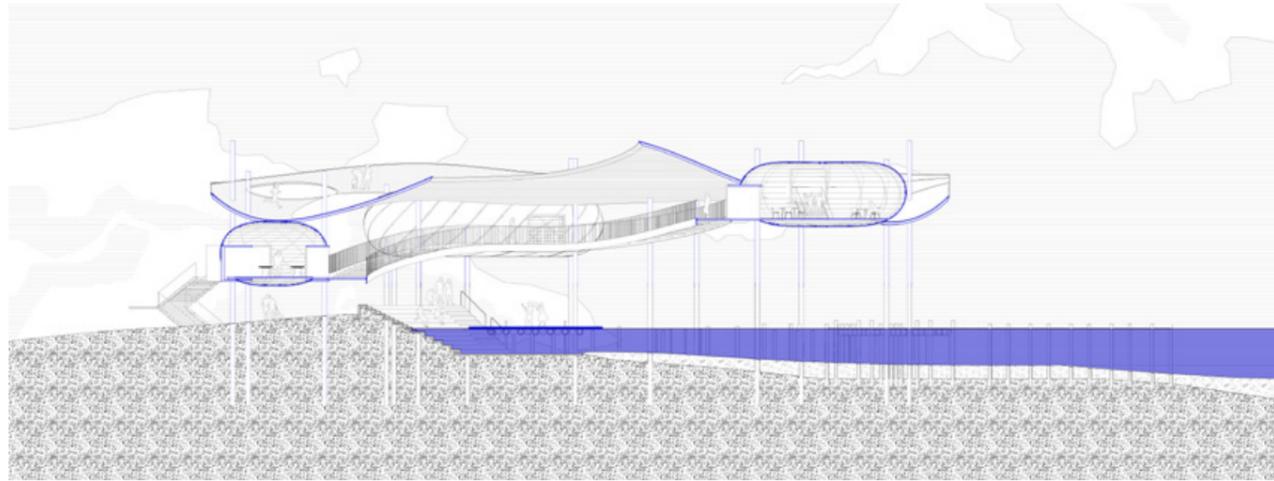
A WHOLE EXPERIENCE OF EATING

The menu is about local seafood and other organic ingredients. We suggest a whole experience of eating, not only eating in a restaurant, but the whole process since the arrival to the satisfied departure. The experience consist of natural wetlands, seafood, activities, and public and community events.



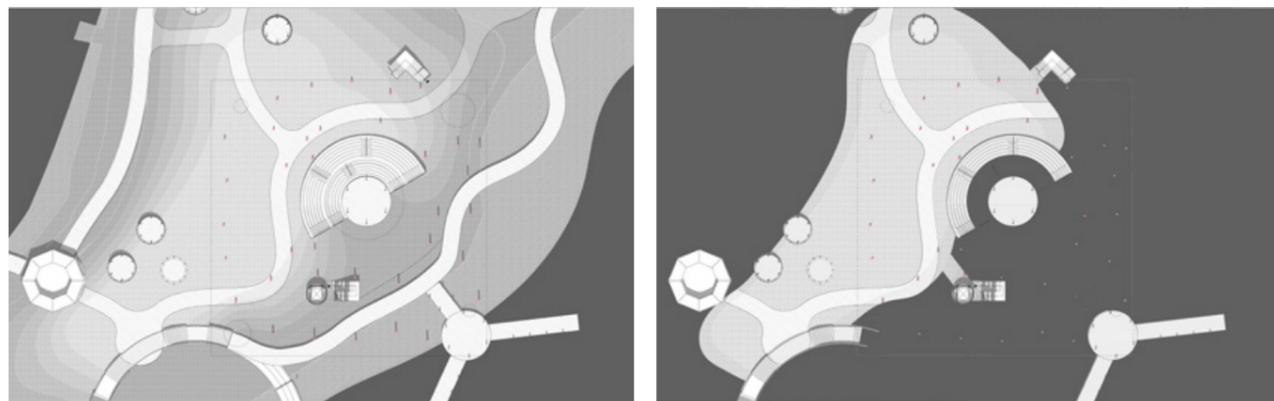
WHEN SEA LEVEL RISES

The curved shape punctures in the roof made the roof available to keep water for roof planting also permeable for rainwaters to go down. And the surfaces of the bubbles are designed with grooves to let water down to prevent the rooftop planting being flooded.



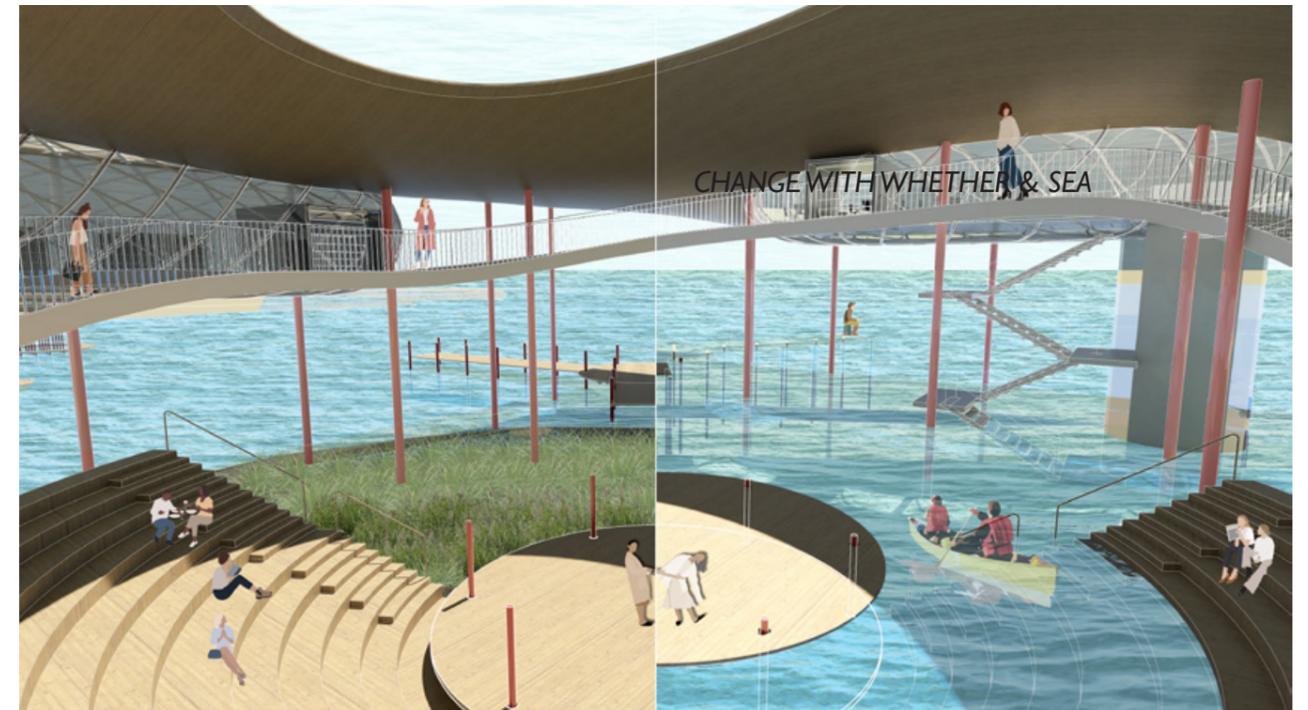
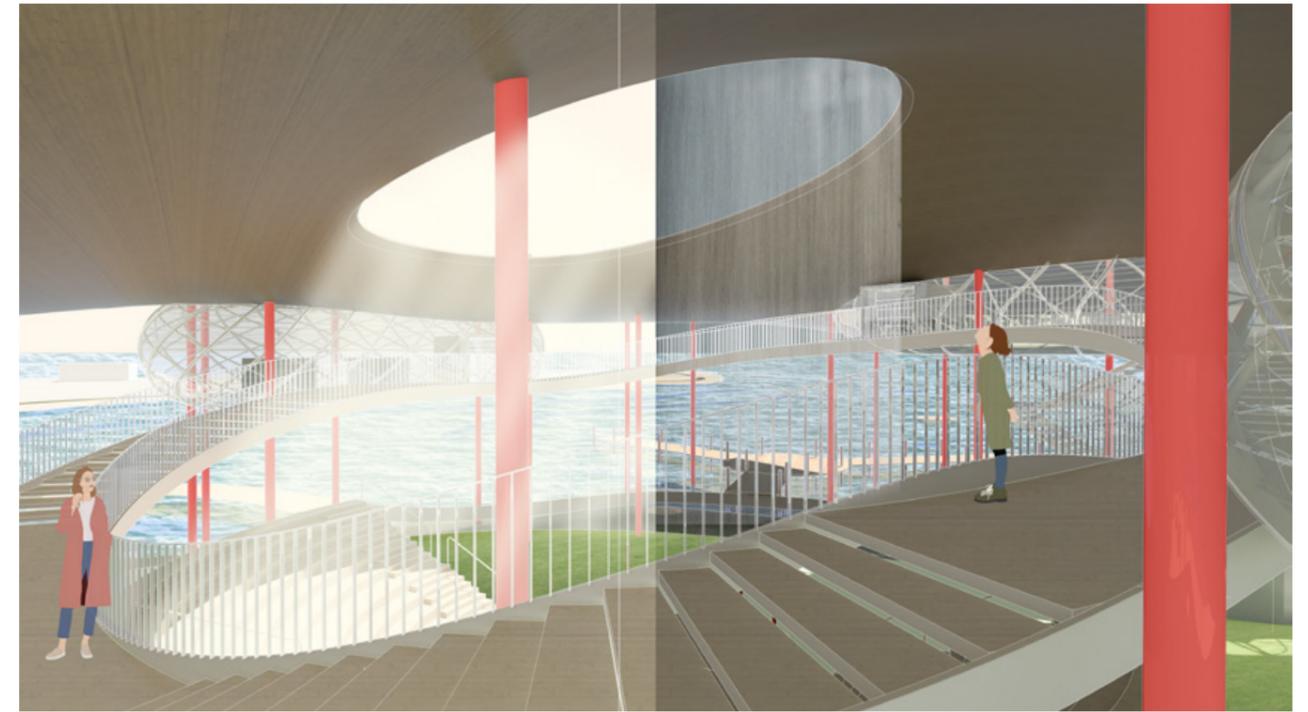
RAIN BACK TO SEA

You can also witness the sunlight or rainwater through the punctures of the roof, depending on the weather. So the rainwater becomes more intimate to people, especially from the theater downstairs. The complex buoy is also able to adapt the sea level rise. As the sea level rises, the stage in the center is designed to float to a higher level as the water comes up and invades into the theater.



THEATER STAGE & SEA

The complex buoy is closed connected to the community and other land buoys through entrances and boardwalks. Then we get the system of bubbles and surface elevated from the ground so it can keep available in case the sea level rises



So it is also available as a theater with a higher sea level, there may even be performances on water. And it may be accessible by boat through the marina, instead of by cars. In all, we suggest not only a series of land buoys or a mere restaurant, but also a more intimate relationship between the human and the nature, and a sustainable development of the Mastic Beach Community.