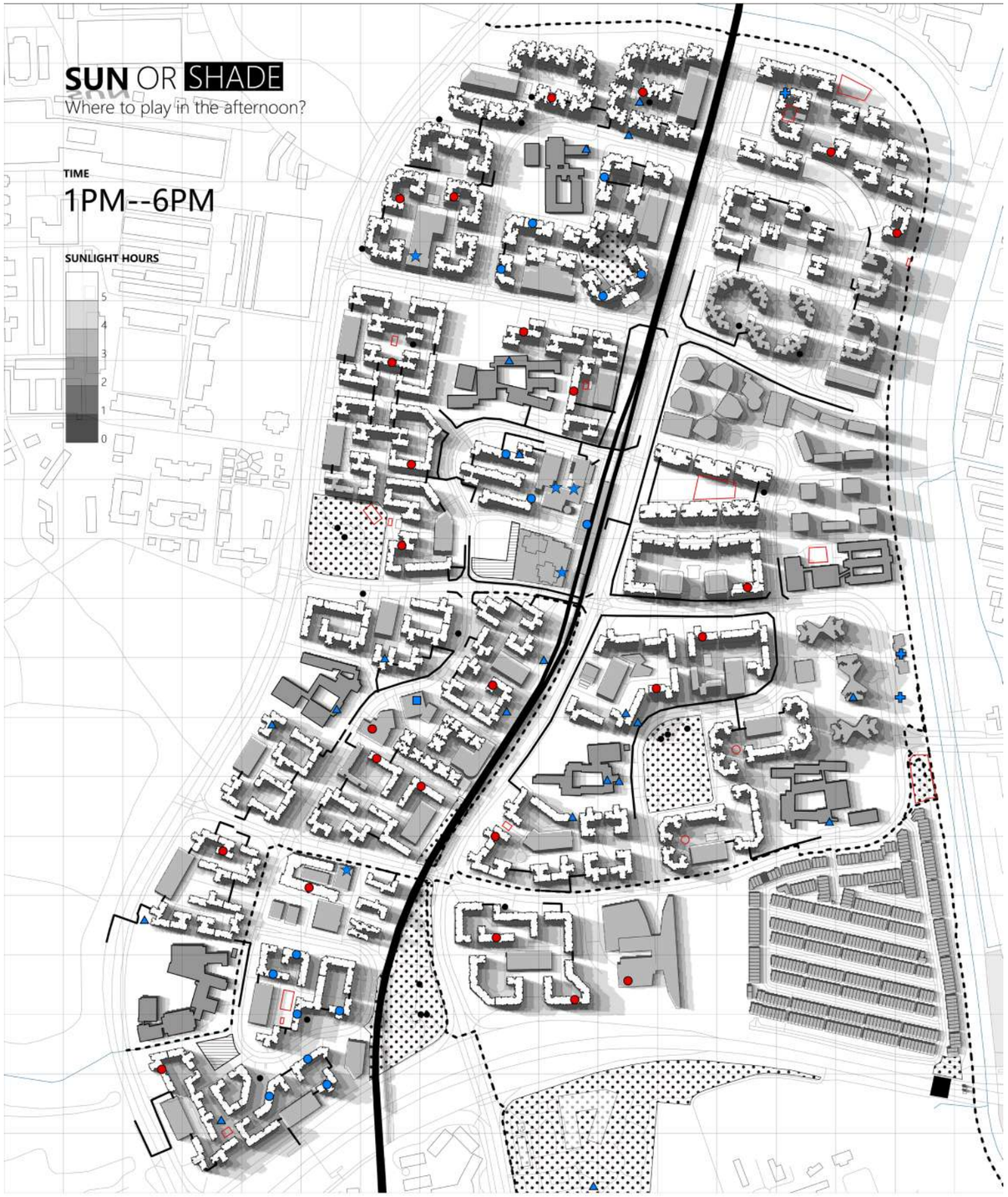
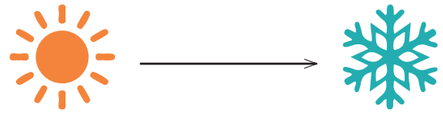




FROM SOLAR TO COOLER

Individual Academic Work
Instructor: Mayura Patil

Location: Choachukang, Singapore
Autumn. 2023

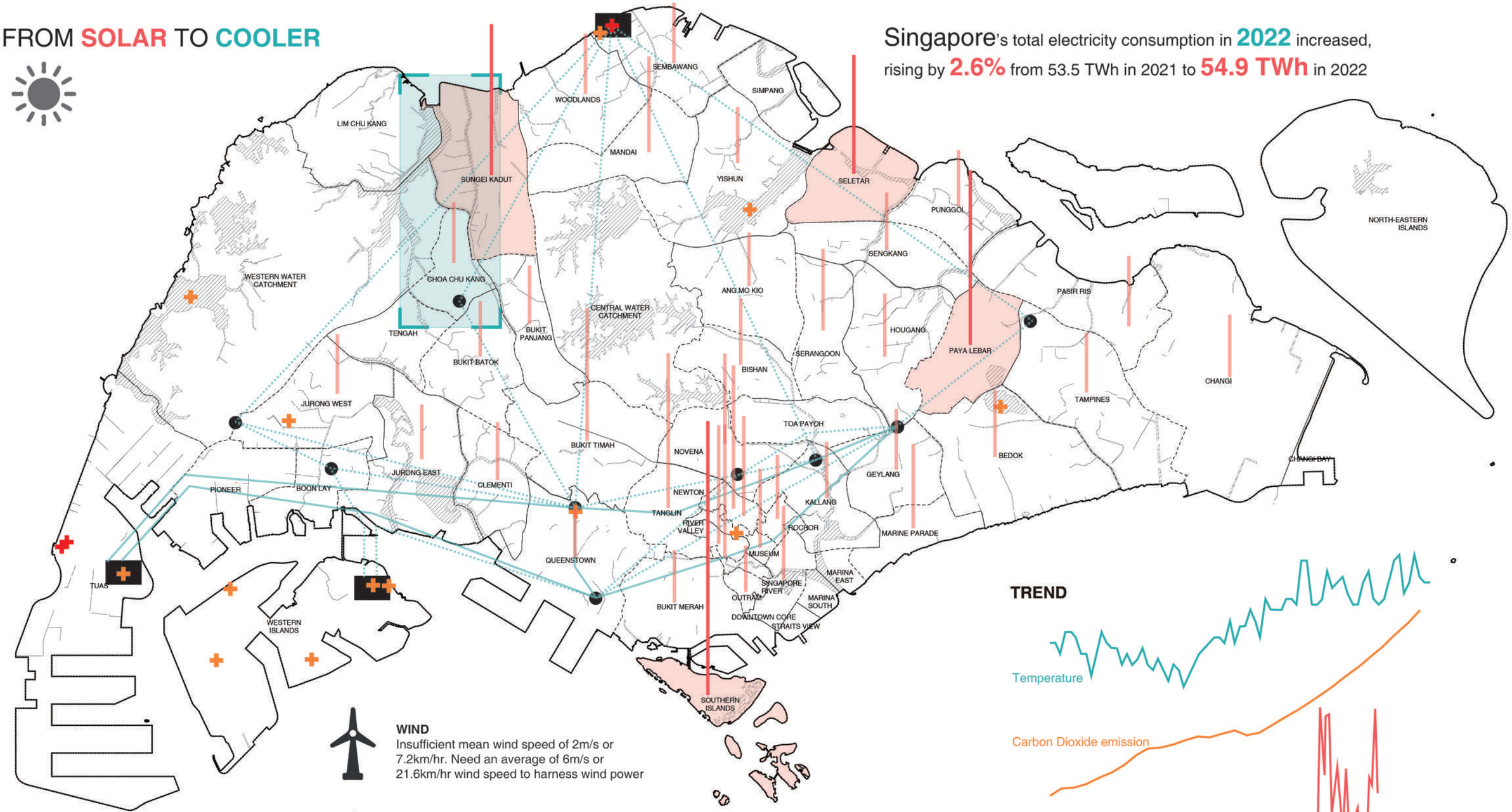
In recent years, the price of electricity has tripled, due to international events, and it is important for Singapore to find a stable energy resource it self. But according to some research, the wind tital , water ,are not that suitable for singapore.

Singapore is a perfect place to develop solar erengy, it gets a lot of sunshine.

Given Singapore's tropical climate with year-round summer, protecting people vulnerable to heat stress is indeed a challenge. This project focuses on future solar energy development to mitigate heat stress among people. It utilizes vacant land within communities as a platform. The project aims to develop a system design that provides financial support and innovative land use strategies.

FROM SOLAR TO COOLER

Singapore's total electricity consumption in **2022** increased, rising by **2.6%** from 53.5 TWh in 2021 to **54.9 TWh** in 2022



Legend

- Power station (solar)
- Transmission station
- 400kv Grid
- 230kv Grid
- Study area
- High electricity comsumption area

WIND
Insufficient mean wind speed of 2m/s or 7.2km/hr. Need an average of 6m/s or 21.6km/hr wind speed to harness wind power

HYDROELECTRIC
Fairly flat. Need a large amount of water and height difference between stored water and turbine plant displacement of wildlife and population

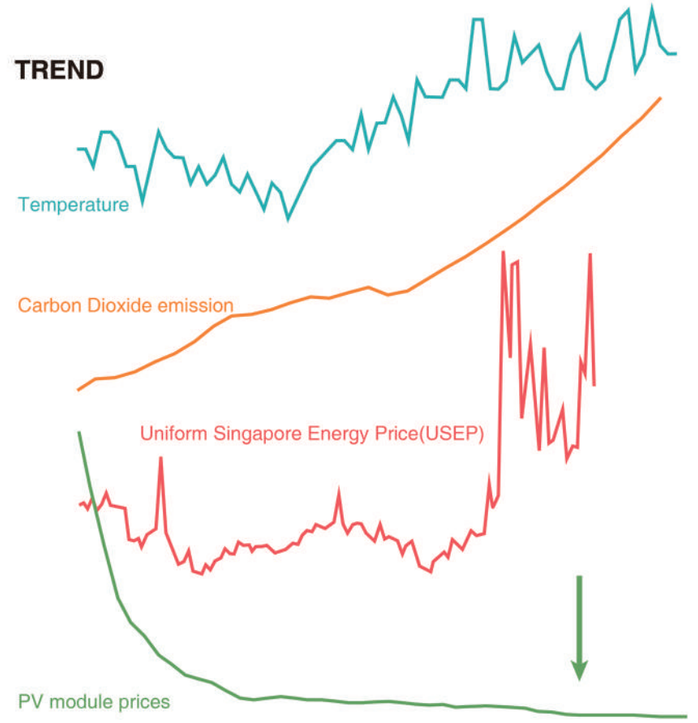
GEOTHERMAML
Only possible in Tekong and Sembawang hot spring at 70C

BIOMASS
Mostly for industrial uses like the incineration Plants, Mainly wood, horticultural, food waste and waste paper.

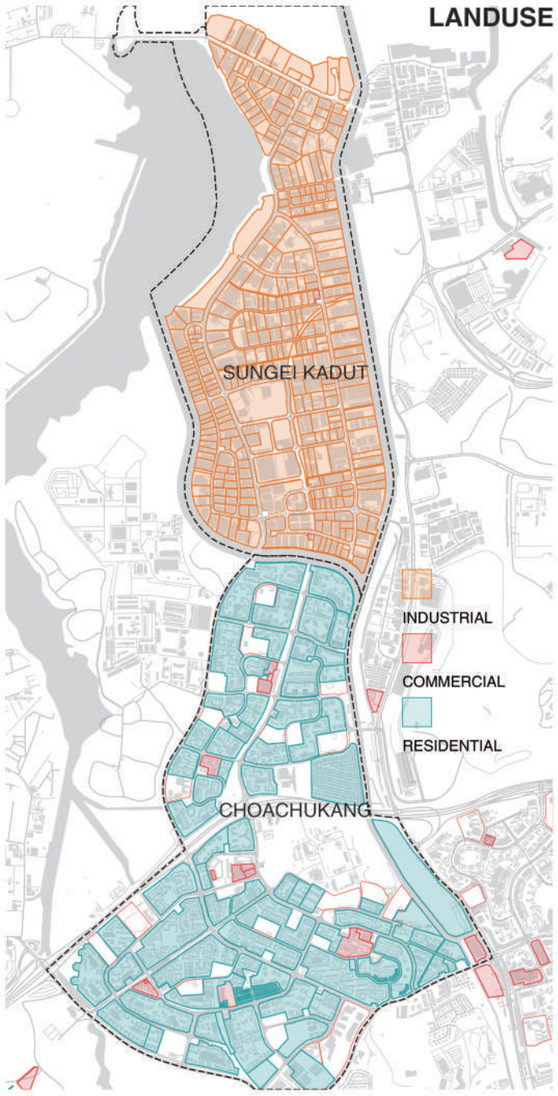
SOLAR
Abundant tropical solar energy
Further improvement in efficiency
√ **MOST PROMISSING ENERGY**

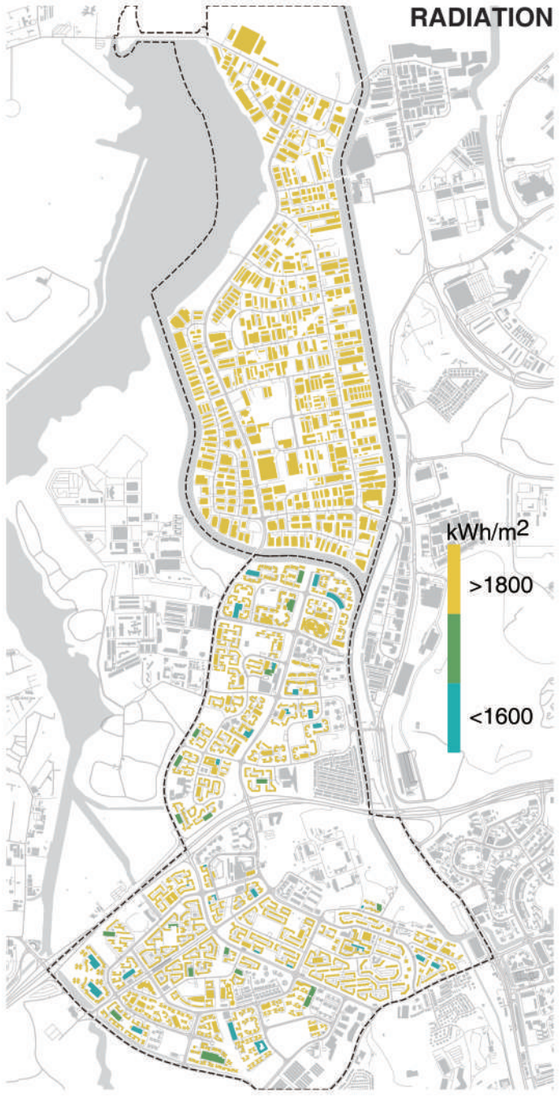
EFFICIENCY OF RENEWABLE ENERGY IN SINGAPORE

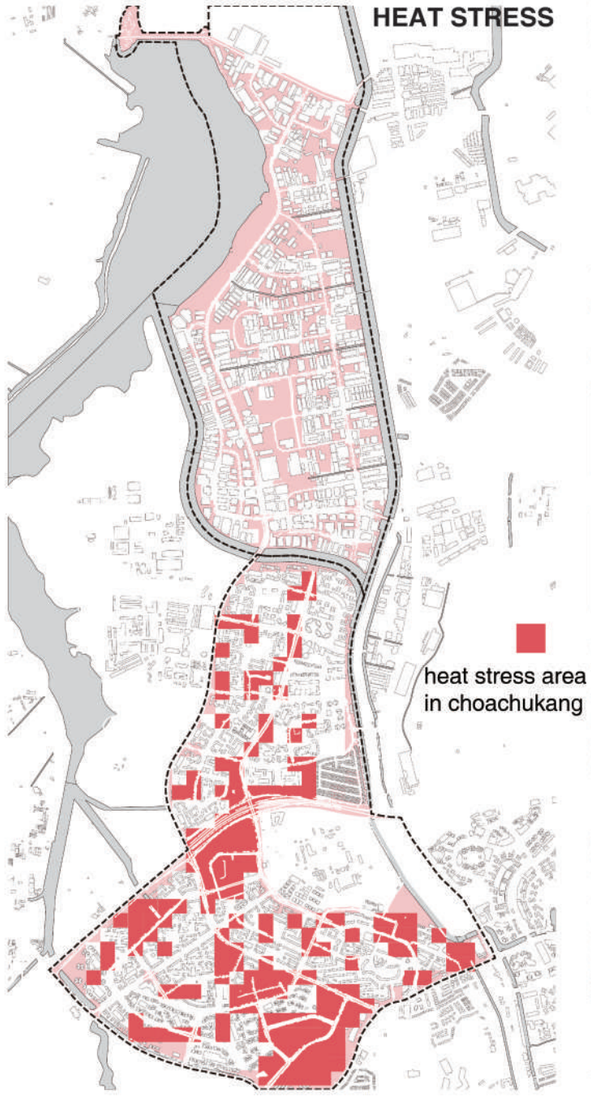
TREND

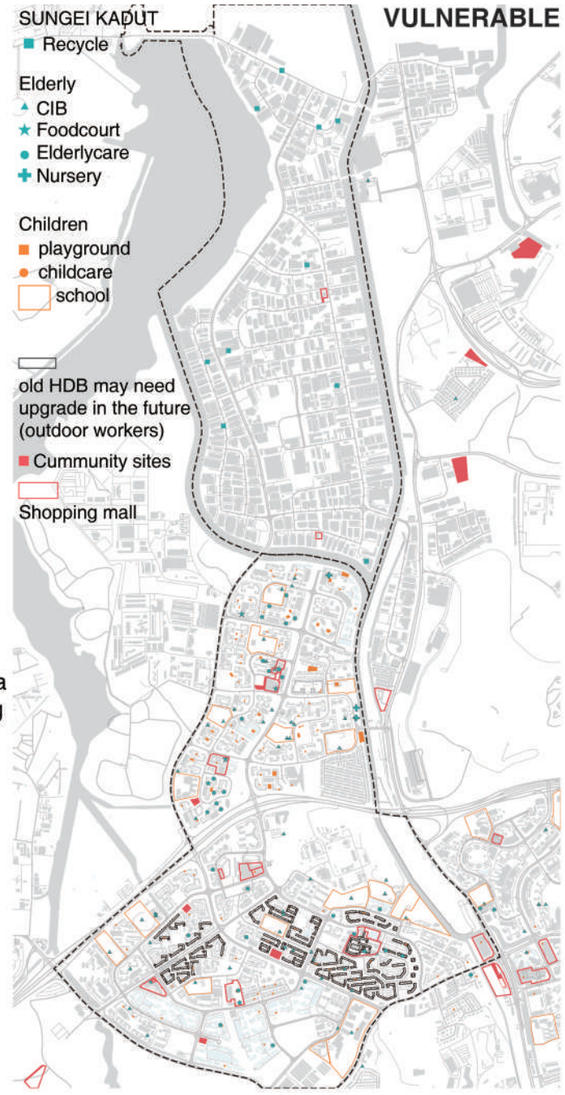


SITE ANALYSIS









ELECTRICITY CONSUMPTION BY SECTOR

INDUSTRIAL 10.9TWh

COMMERCIAL 10.3TWh

HOUSEHOLD 3.8 TWh

Industrial and commercial areas consume far more electricity than residential areas

ELECTRICITY CONSUMPTION BY SECTOR

Solar deployment in Singapore grew significantly over the years, surpassing 1 GWp of solar installed capacity in the first half of 2023. Grid-connected installed capacity increased from 126.0 MWp in 2016 to 1005.7 MWp in the first half of 2023. Singapore is on track to meet 1.5 GWp of solar deployment by 2025, and at least 2 GWp by 2030.

SUNGEI KADUT

FEE:440,840,000$
ROOF:1102099m2
PRODUCE:
277.7Gwh/YR

CHOACHUKANG

FEE:364,440,024$
ROOF:778718m2
PRODUCE:
235Gwh/YR

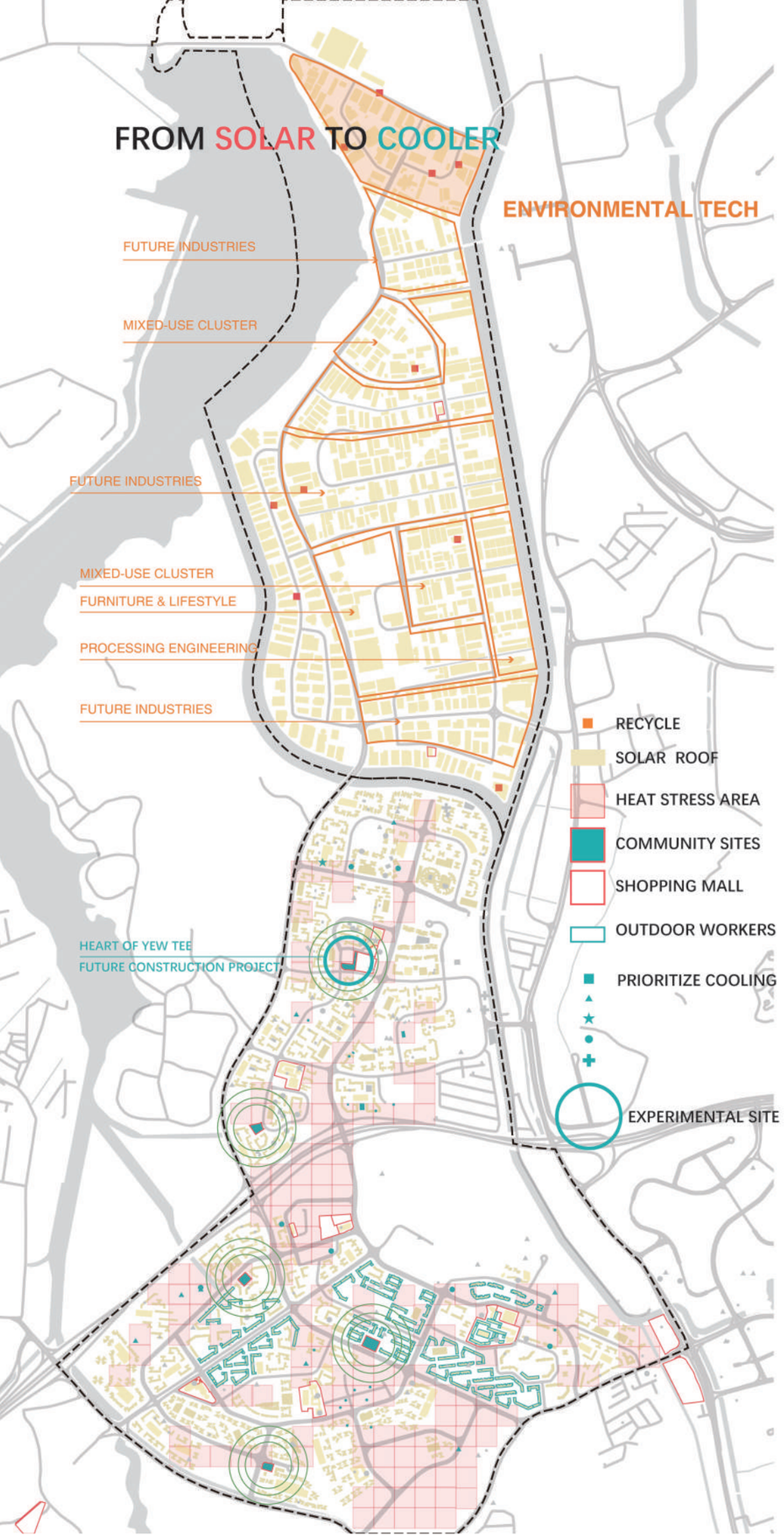
VULNERABLE GROUPS

INFANTS AND CHILDREN

OUTDOOR WORKERS

OLDER ADULTS

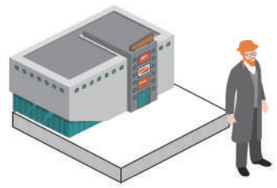
Older adults do not adjust as well as young people to sudden changes in temperature.
They are more likely to have a chronic medical condition that changes normal body responses to heat.
They are more likely to take prescription medicines that affect the body's ability to control its temperature or sweat.



SOCIAL FRAMEWORK OF STAKEHOLDERS

STAGE 1 INVESTMENT

COMMERCIAL



Shopping mall

BUILD SOLAR PANEL

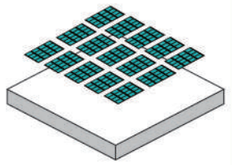
ATTRACTING MORE PEOPLE

COOLING STRATEGY

PLANTING UNDER SOLAR PANEL
COOLING UNDER SOLAR
HELP IMPROVE ITS EFFICIENCY

GARDENING

RESIDENTIAL



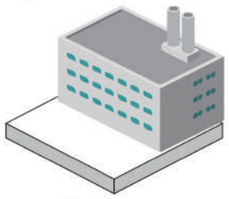
Community site

HDB Rooftop

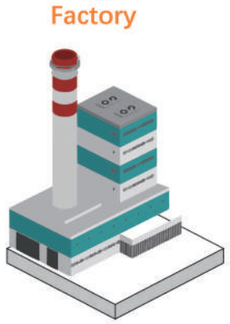
IMPROVE EFFICIENCY

STAGE 2 TRANSACTION

INDUSTRIAL



Factory

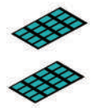


Recycle Insititution

PRODUCE ENERGY

CHEAPER PRICE

EXTRA ENERGY



BUILD MORE SOLAR PANEL

GAIN MONEY

Get pay back in six years and have 61,581,676 every year

USED SOLAR PANEL

25 YEARS

BENEFIT COMMUNITY

TECHNOLOGY SUPPORT

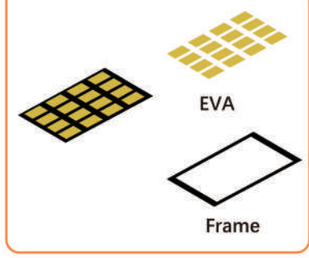
COOLING STRATEGY

COOLING FACADE
PASSIVE COOLING METHOD
NO NEED ELECTRICITY

Outdoor workers

Heat stress area

STAGE 3 RECYCLE



Can be recycled directly

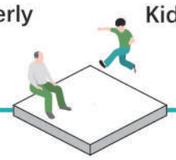
MODULAR DESIGN

COOLING STRATEGY

MORE SHELTER
FOR VUNEREBLE PEOPLE

Elderly

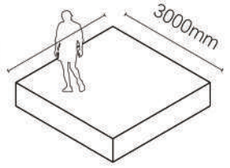
Kids



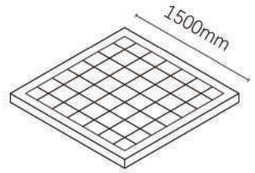
Popular site in afternoon

BASIC MODULE

Module design is based on the size of the solar panel.
There are mainly four basic units.
SOLAR PANEL
MOBILE PLANTER
VERTICAL FACADE
BASIC FRAME
Four structures with different functions can be formed through different combinations
SOLAR COOLING PANEL
GARDENING SET
SHELTER(CONSTRUCTION/COMMUNITY)
FACADE(AIR COOLING/ DUST ABSORB)



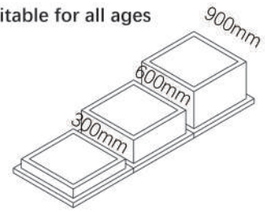
UNIT 1



SOLAR PANEL

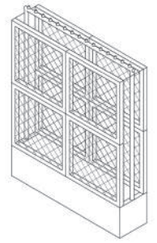
UNIT 2

Suitable for all ages



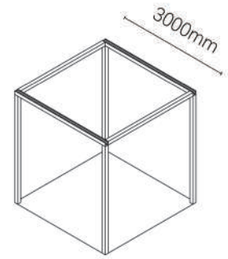
MOBILE PLANTER

UNIT 3



VERTICAL FACADE

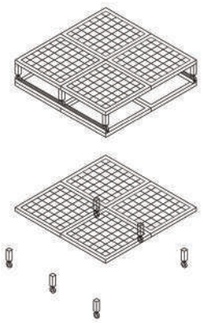
UNIT 4



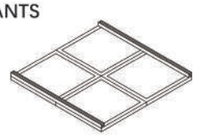
BASIC FRAME

TYPE 1

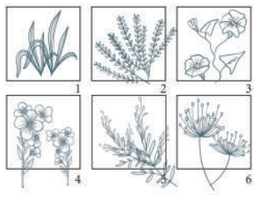
SOLAR COOLING PANEL



PLANTS



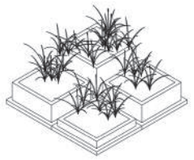
Grass



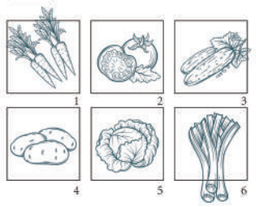
1 Ophiopogon japonicus
2 Buxus bodinieri .
3 Vinca major .
4 Viola tricolor .
5 Lonicera japonica.
6 Lycoris radiata

TYPE 2

GARDENING SET

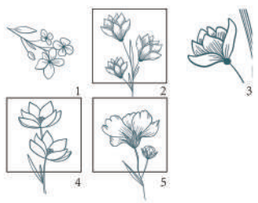


Crop



1 Daucus carota.
2 Lycopersicon esculentum
3 Solanum tuberosum.
4 Cucumis sativus.
5 Brassica oleracea.
6 Brassica rapa.

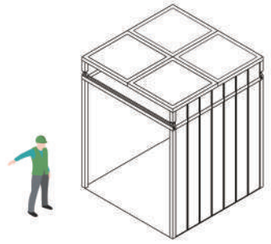
Shrub



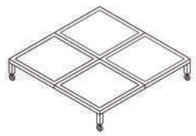
1 Forsythia suspensa
2 Rhododendron simsii.
3 Hosta plantaginea.
4 Gardenia jasminoides Ellis
5 Rosa chinensis .

TYPE 3

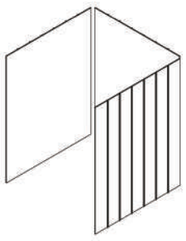
SHELTER(CONSTRUCTION)



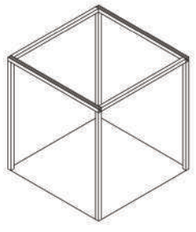
Cover



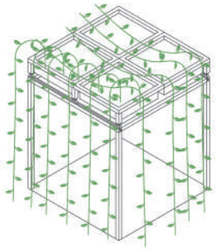
Wall



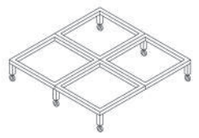
Frame



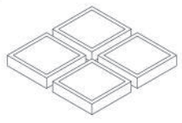
SHELTER(COMMUNITY)



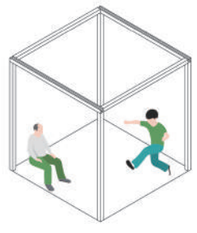
Cover



Planter

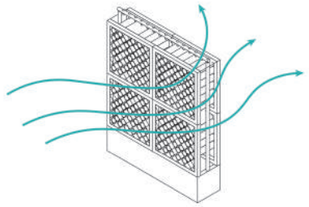


Frame

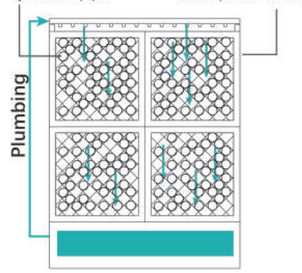


TYPE 4

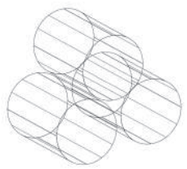
AIR COOLING



Cylindrical pipe Solar panel frame

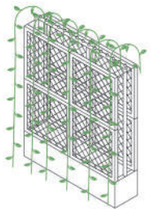


Water tank

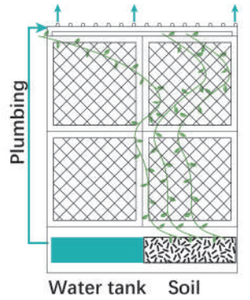


Can be recycled on construction sites and industrial areas

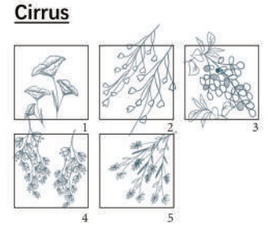
DUST ABSORB



Produce mist

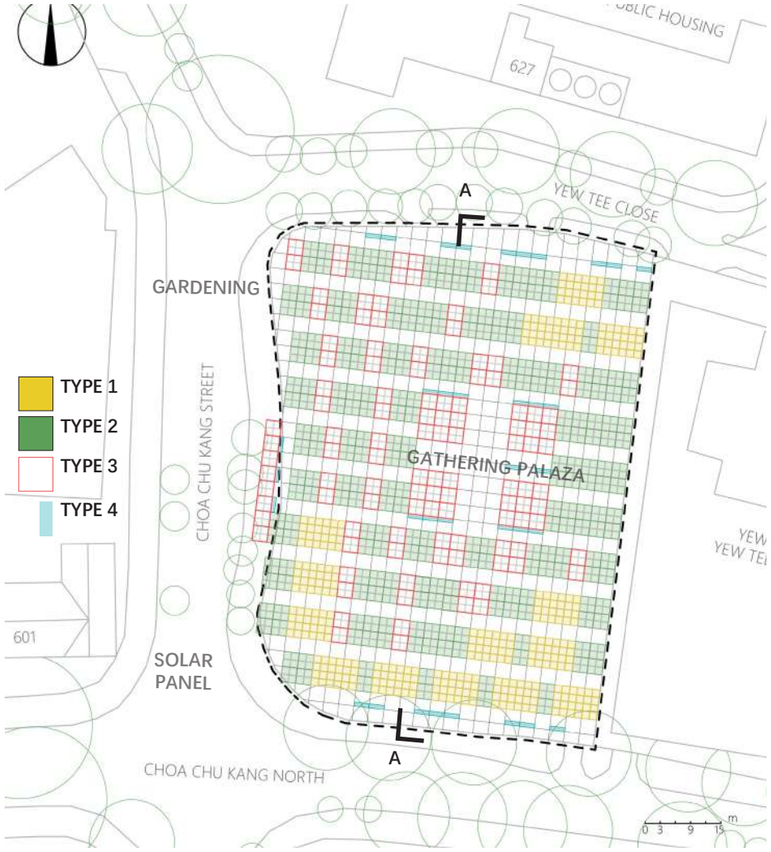


Cirrus



1 Campsis grandiflora.
2 Hedera nepalensis.
3 Vitis vinifera.
4 Wisteria sinensis.
5 Jasminum nudiflorum.

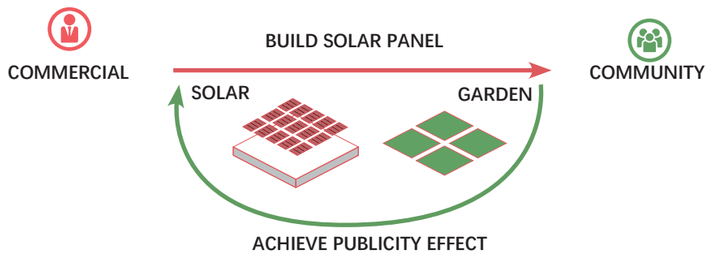
STAGE



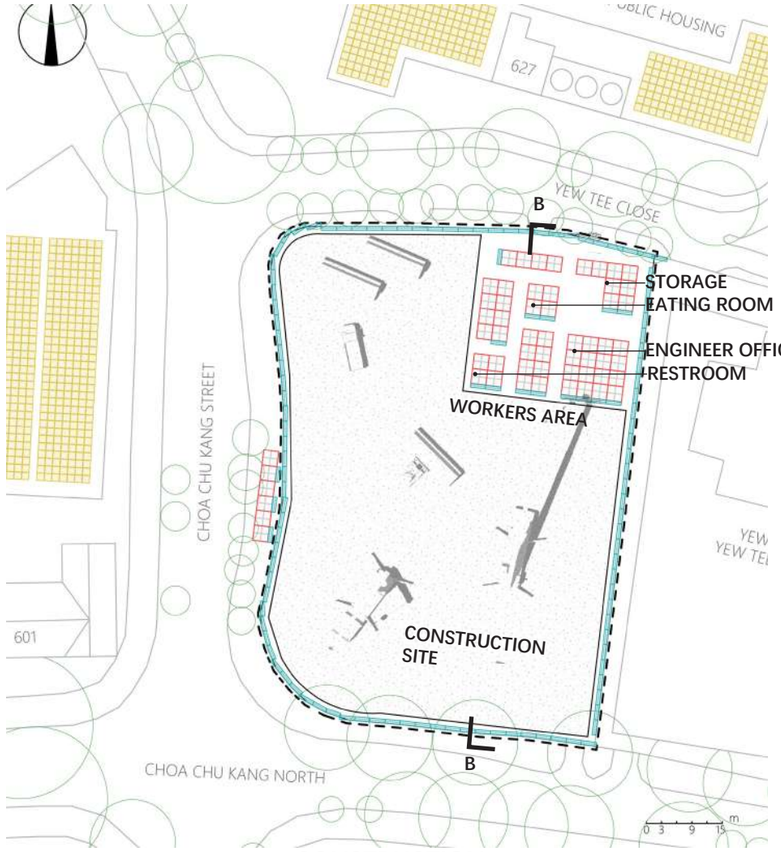
SOLAR FARM

STAGE 1

SOLAR FARM

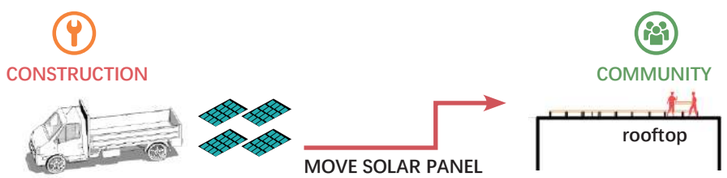


In Stage 1, solar panels and planting ponds are arranged on the vacant land. The planting ponds not only attract people but also help cool down the solar panels, thereby increasing their energy conversion efficiency. The energy collected during this stage is used to offset the installation costs as well as other maintenance expenses.

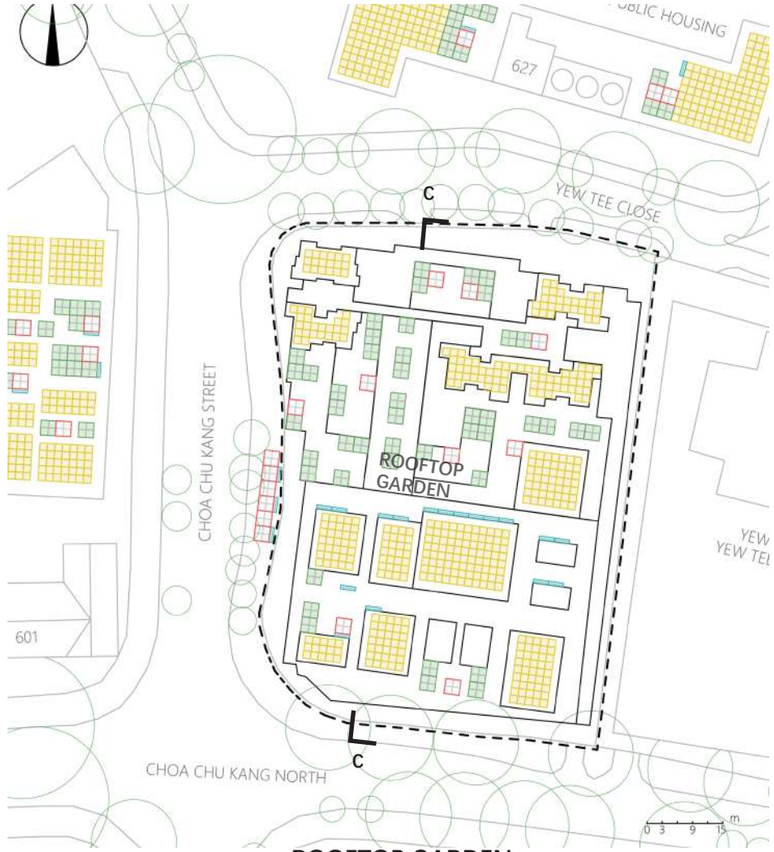


CONSTRUCTION

STAGE 2

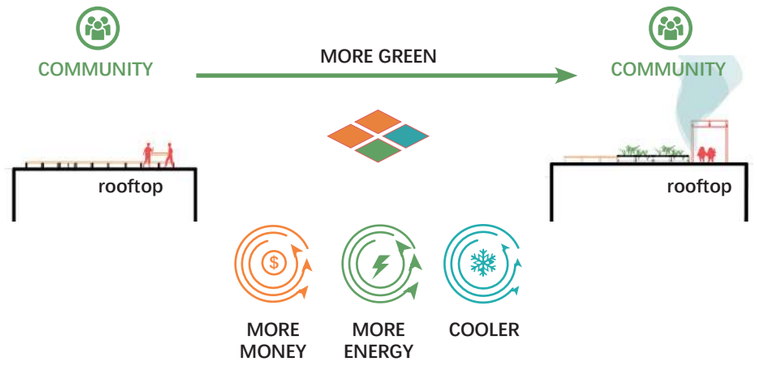


In Stage 2, when the vacant land has new construction plans, the solar panels and flower ponds can be relocated to suitable rooftops of surrounding HDB buildings, providing energy for the surrounding HDBs and rooftop gardens. At the same time, some modules can remain on the construction site, providing infrastructure for worker operations.



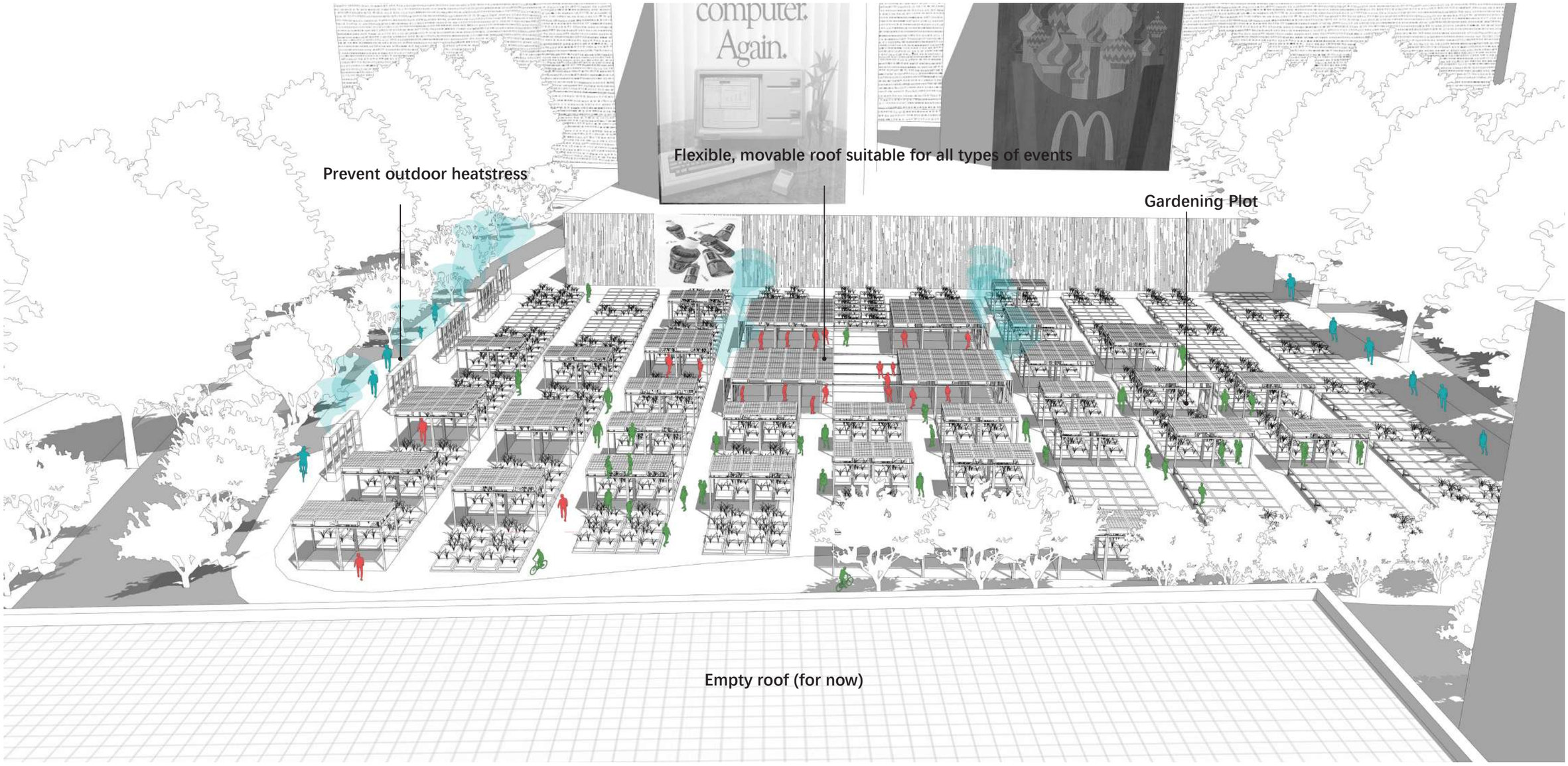
ROOFTOP GARDEN

STAGE 3



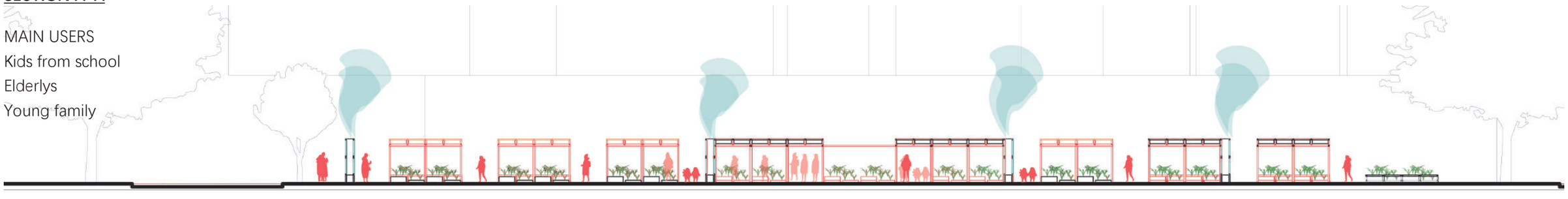
In Stage 3, the accumulated electrical energy converted from solar power can be sold. More building rooftops can be equipped with planting ponds, solar panels, and cooling modules.

STAGE 1 SOLAR FARM

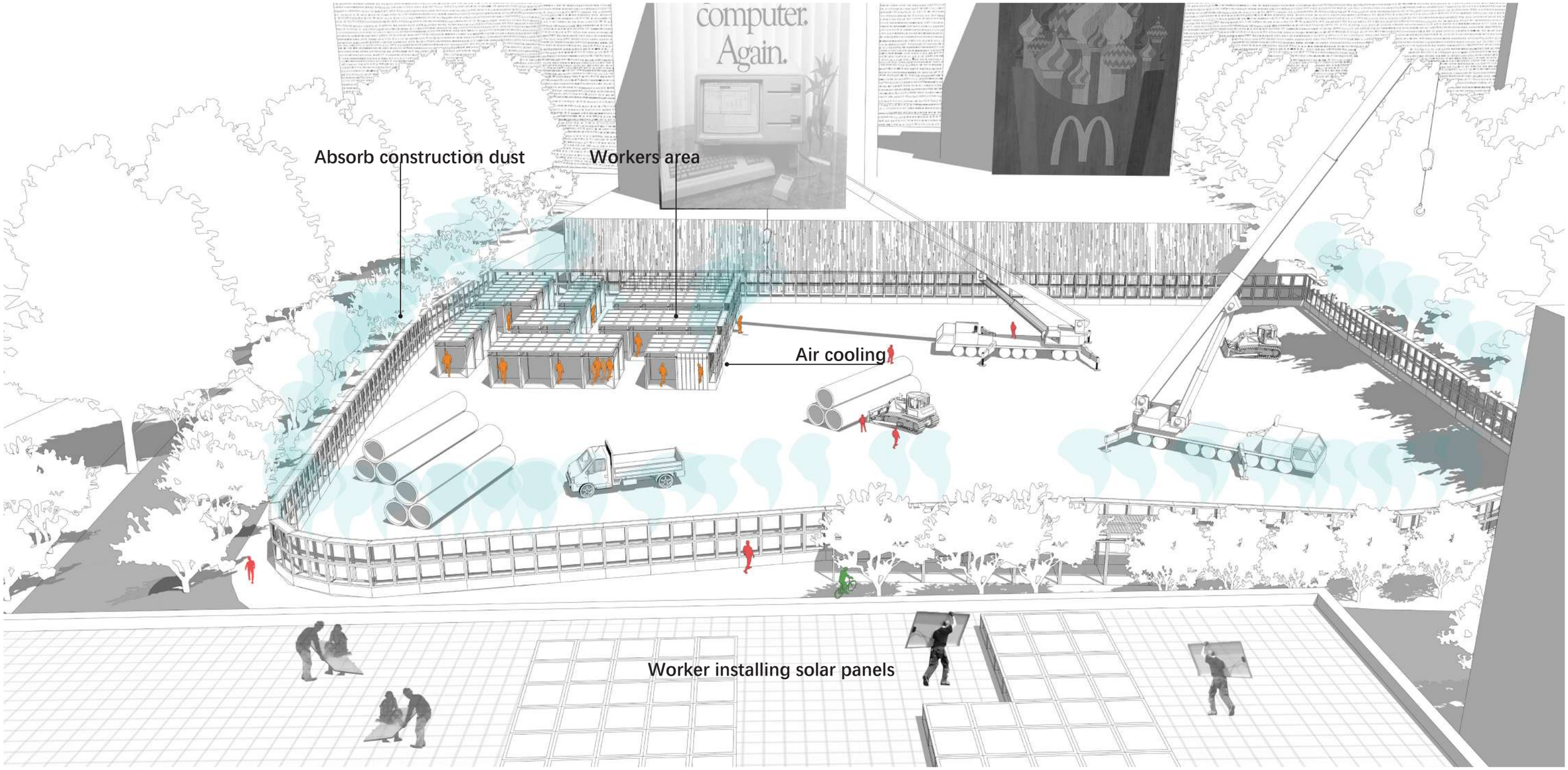


SECTION A-A

MAIN USERS
Kids from school
Elderlys
Young family



STAGE 2 CONSTRUCTION



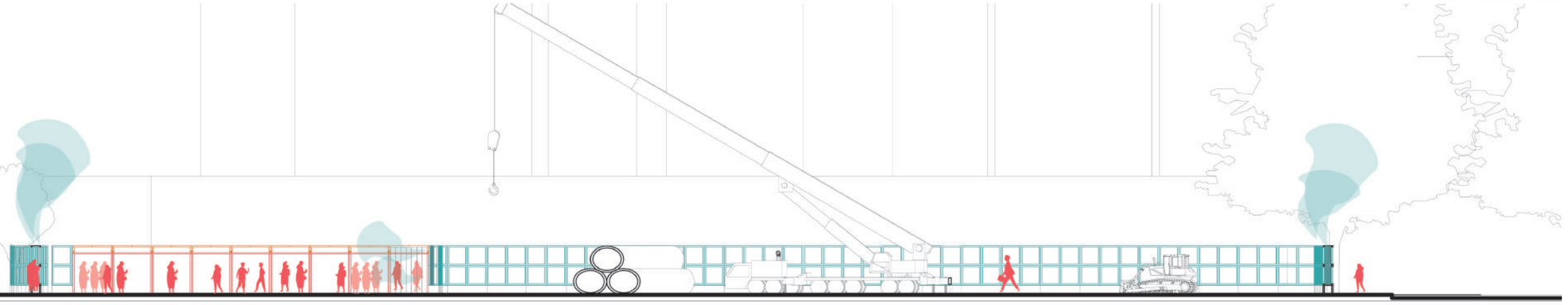
SECTION B-B

MAIN USERS

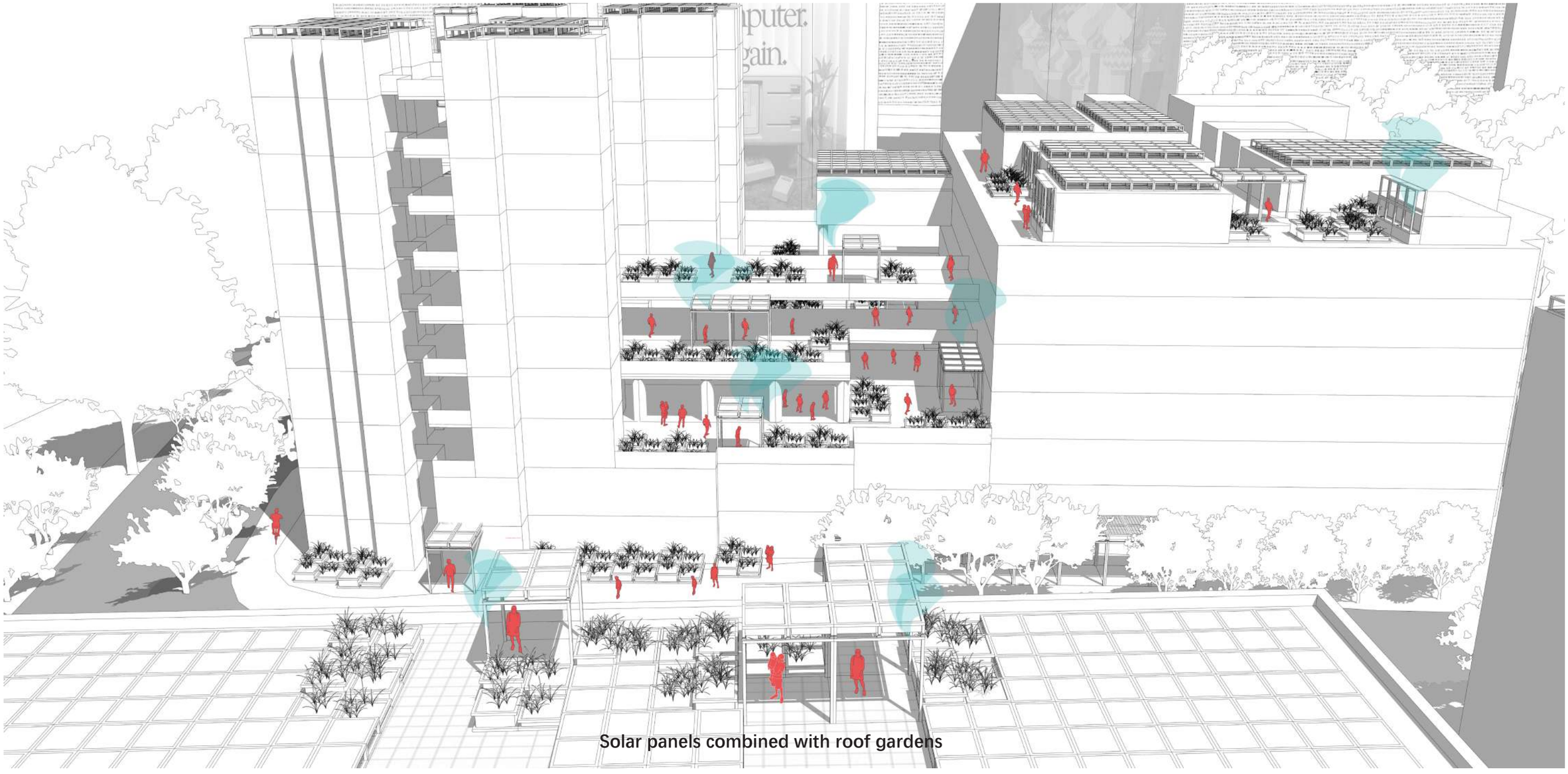
Kids from school

Elderlys

Young family



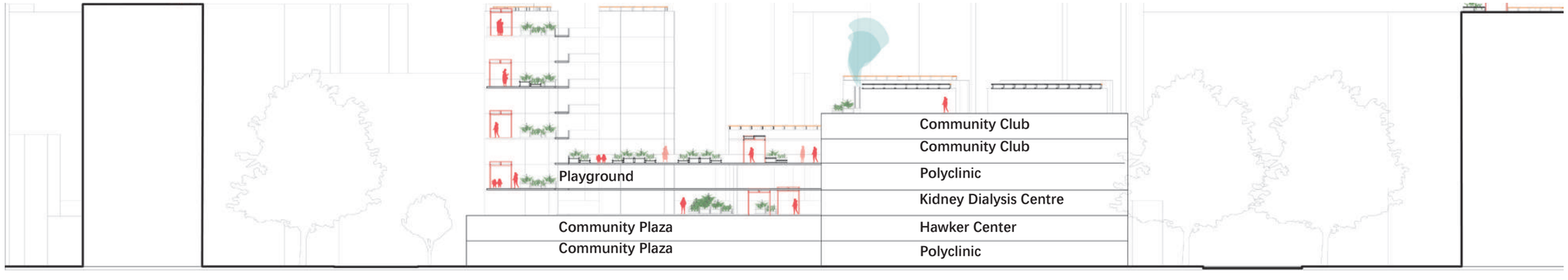
STAGE 3 ROOFTOP GARDEN



SECTION C-C

MAIN USERS

All residents near by



LA 4702 MLA Studio: Designing Sustainable Infrastructure: Materials, Methods, Technologies
AY 2023-24, Semester 2

COOL GO

Electric Transit and Cooling Station

Studio Tutor: Max hrish

ZHU LUJIA
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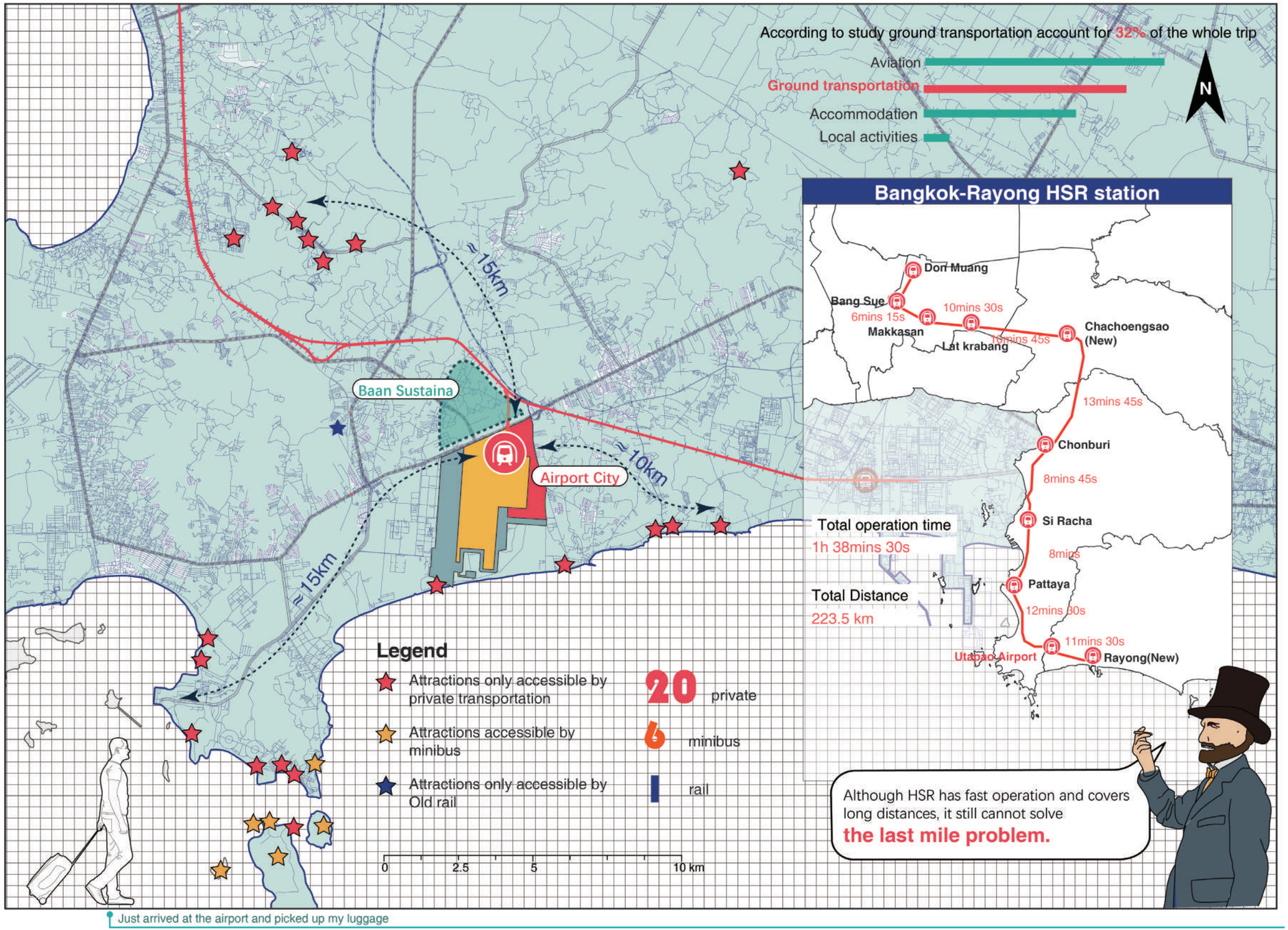
COOL GO

In our vision for the future transportation network near utapao airport, our goal is to establish efficient connections to surrounding unexplored attractions, enhancing the tourist experience through sustainable travel options. Thailand is currently promoting the development of electric vehicles, the EEC can offer support for usage of electric vehicles in the region. And by establishing a public EV transportation network It will significantly reducing carbon emissions from road traffic.Furthermore, due to climate change, the eastern region is forecasted to experience particularly hot and dry conditions. To enhance tourists' outdoor experience, we will explore passive cooling designs that reduce temperatures without significant energy consumption.

According to research, for a journey, ground transportation accounts for 32% of carbon emissions. With the expected increase in passengers in the Utapao , carbon emissions from ground transportation are also expected to increase significantly. Additionally, there are many deficiencies in the current transportation services in this area, such as Insufficient frequency of buses , Foreign tourists are often overcharged by taxi drivers., and issues with passenger luggage management.

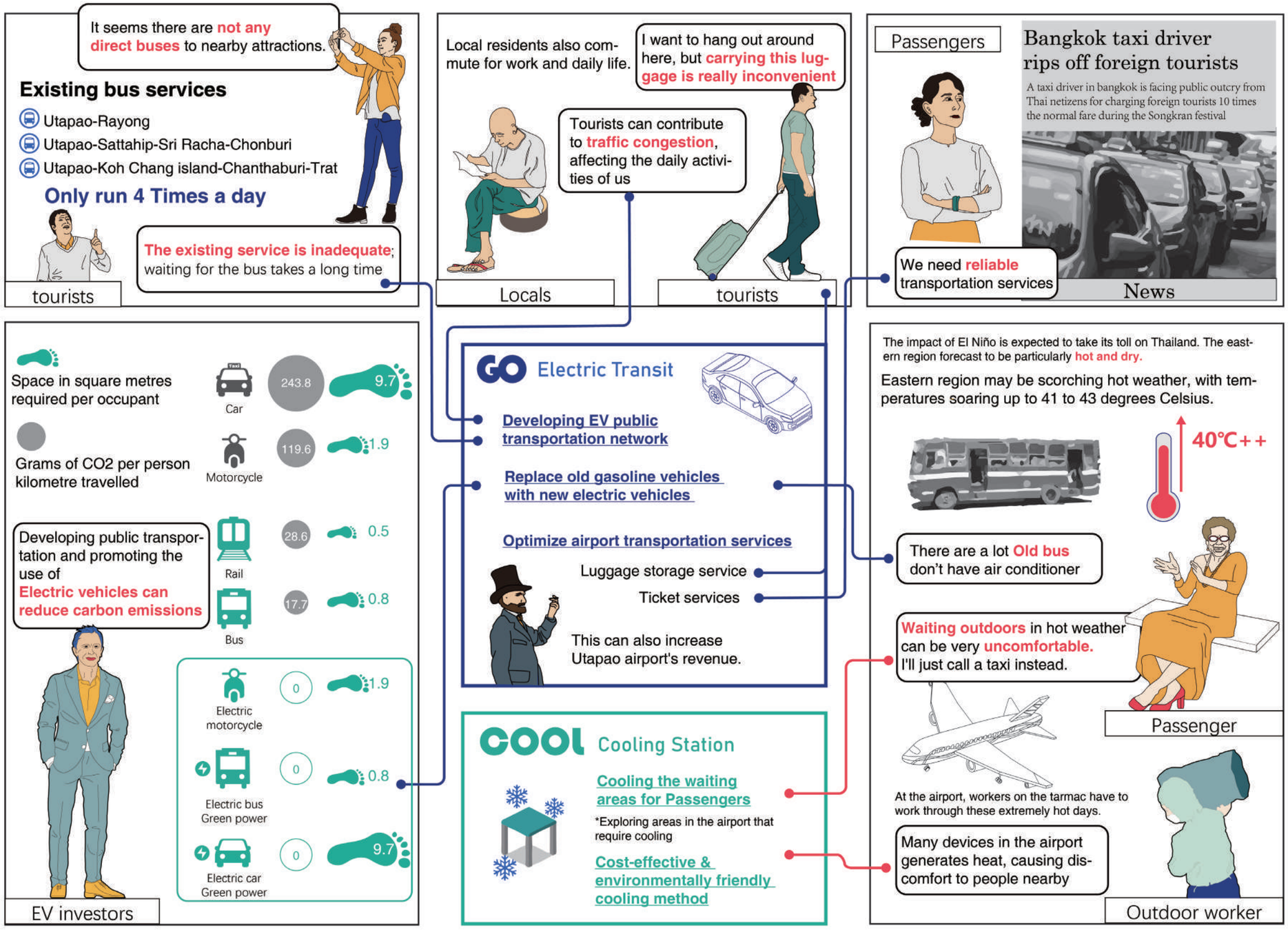
And also regarding the impact of climate change: Due to the influence of the El Niño climate, the eastern region will become very hot and dry. Currently, some old buses in Thailand do not have air conditioning, and the hot weather can affect passengers' choices to use public transportation. The hot environment can also have negative health effects on outdoor workers.

To address the current deficiencies in transportation services and the issue of hot environments, I propose two strategies: the first is Go Electric Transit, and the second is Cool Cooling Station.



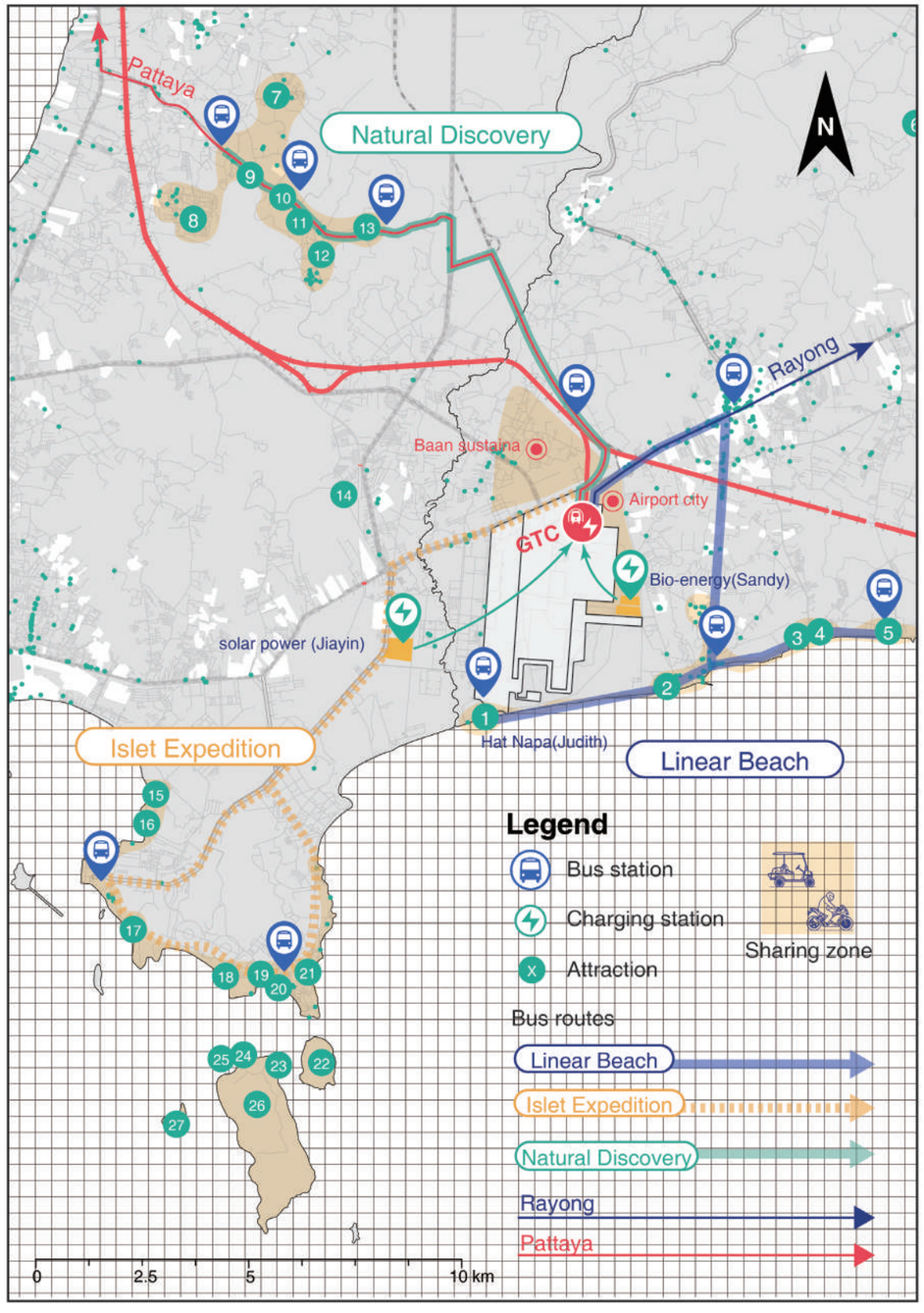
Mapping of Existing transportation services

By 2030, ahigh-speed rail will be completed. It will significantly reduce travel time between different regions of the EEC. In the future. However, the high-speed rail still cannot solve the “last mile problem” in this region. From the map on the left, we can see that all these red stars represent attractions that can only be reached by private services. Therefore, it is essential to establish an efficient transportation network to solve the “last mile” problem in this area.



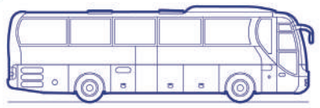
Deficiencies and Strategies

There are many deficiencies in the current transportation services in this area, such as Insufficient frequency of buses , Foreign tourists are often overcharged by taxi drivers., and issues with passenger luggage management. Currently, some old buses in Thailand do not have air conditioning, and the hot weather can affect passengers' choices to use public transportation. The hot environment can also have negative health effects on outdoor workers.



OPERATIONAL CAPABILITY

Electric bus



Responsible for serving long distance tour

300km per charge

Capacity: 60

Electric minibus

Provide long-distance services for a small number of to

200km per charge

Capacity: 20

Electric car

Provide more timely and personalized service

250km per charge

Capacity: 5

Electric Tuktuk

Shared services within short distances

150km per charge

Capacity: 3-4

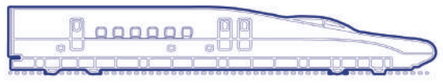
Electric motorcycle

Shared services within short distances

50km per charge

Capacity: 2

High speed rail

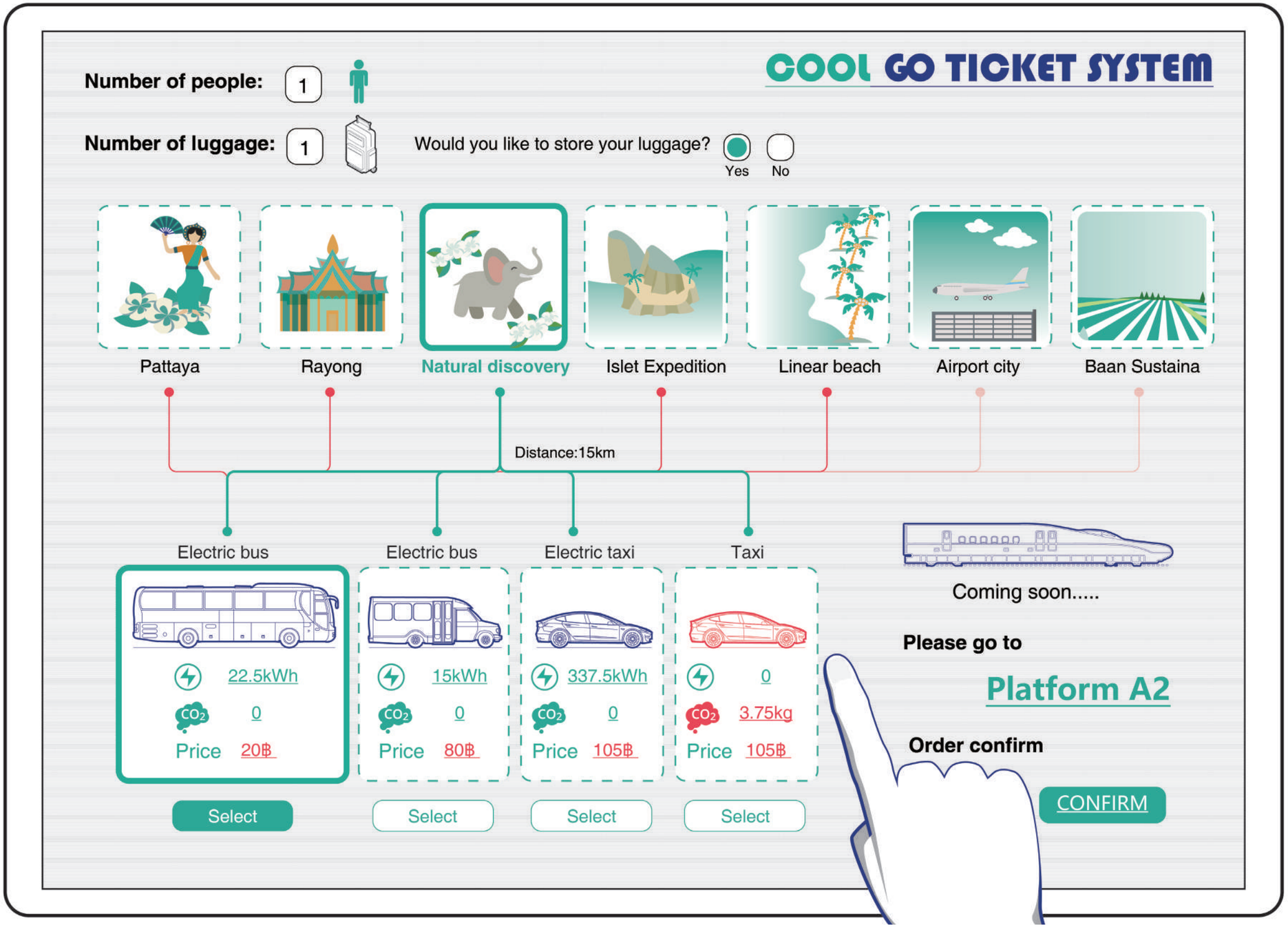


Provide long-distance inter-regional services.

Capacity: *100/carriage

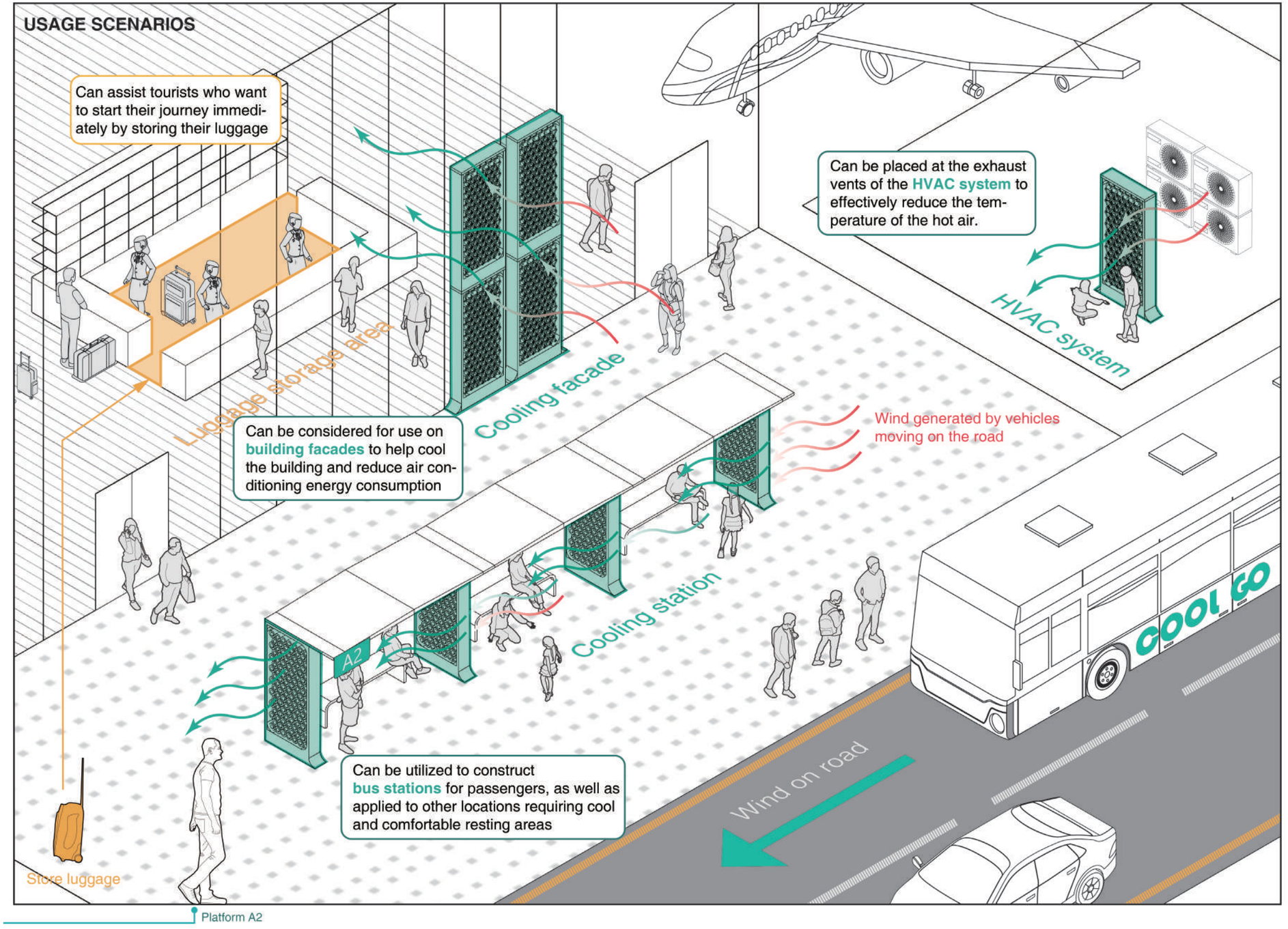
Mapping of all bus routes and operation range for different types of electric vehicles

The map displays three tourist routes. These routes can be serviced by Electric buses and Electric minibusses.And the yellow areas on the map indicating short distances services. In these locations, Electric tuk-tuks and electric motorcycle can be shared.These electric vehicles are supplemented by green energy generated from Jiayin's solar panel and Sandy's biomass energy. These energy sources will provide power for charging stations in ground transportation centers through the power grid.



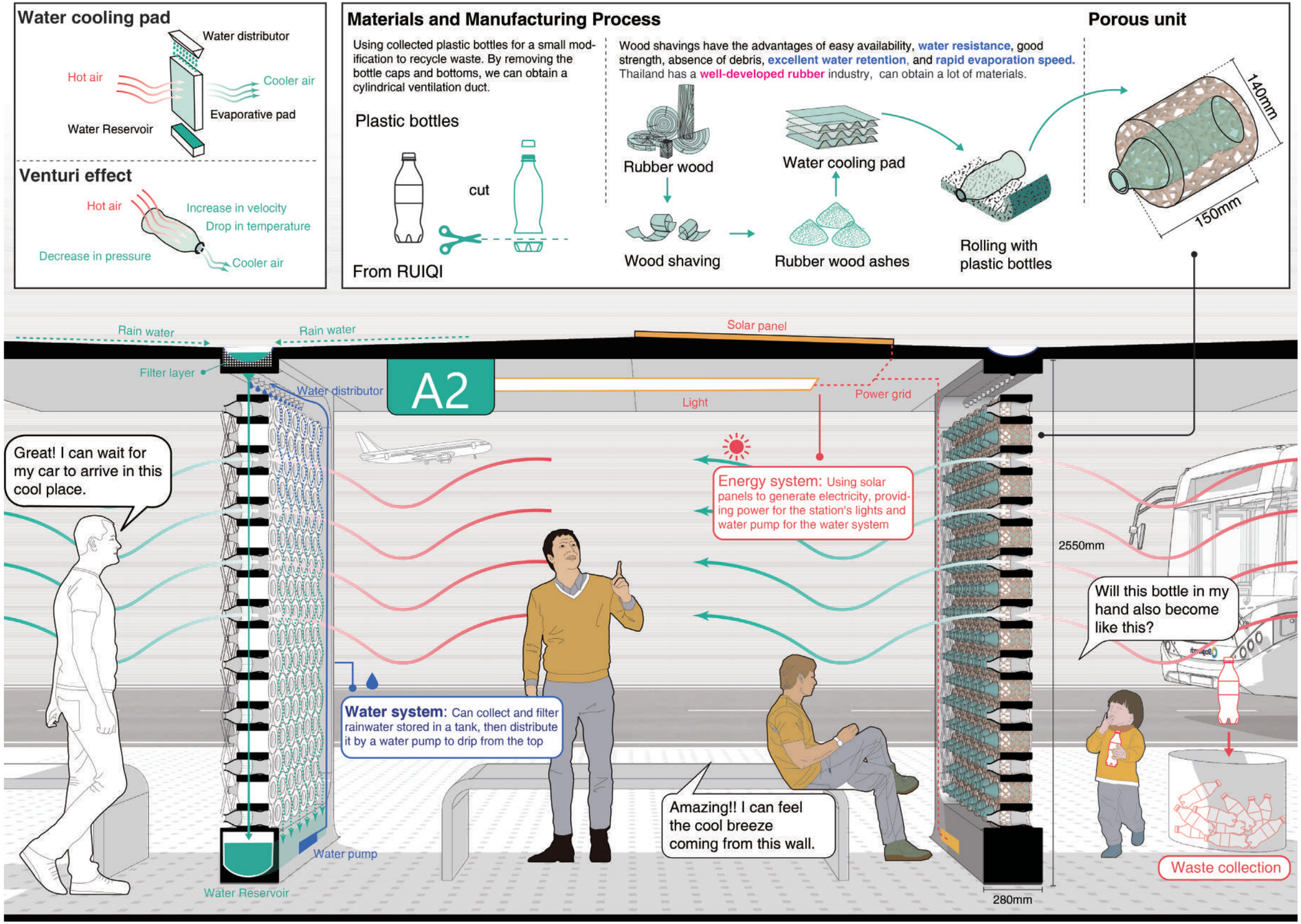
COOL GO ticket system workflow

For example, a tourist inputs the number of passengers, the number of luggage items, and whether luggage storage service is needed, then inputs the desired destination. The system automatically filters available transportation options. For example, if the tourist selects a ticket to Natural Discovery, the system provides all available transportation modes, comparing energy consumption, carbon emissions, and prices of different options.



Potential usage scenarios

There are also other potential use cases include:
It can be installed on building facades for cooling and reducing air conditioning usage.
And also it can Cool hot air generated by HVAC systems in the airport.(Heating, Ventilation, and Air Conditioning)



Cooling principles and section

The cooling wall will integrate with water and solar energy systems. For the water system: Rainwater can be collected and filtered at the top, and then stored in a tank at the bottom via pipes, and pumped back up on the top for distribution. Water circulates back to the tank after passing through the cooling wall. For the energy system: The station's lights and water pumps can be powered by solar panels on the top.

LA 5701 MLA Studio: Country
AY 2024-25, Semester 1

The World Out There

Studio Tutor: Jessica bridger

ZHU LUJIA
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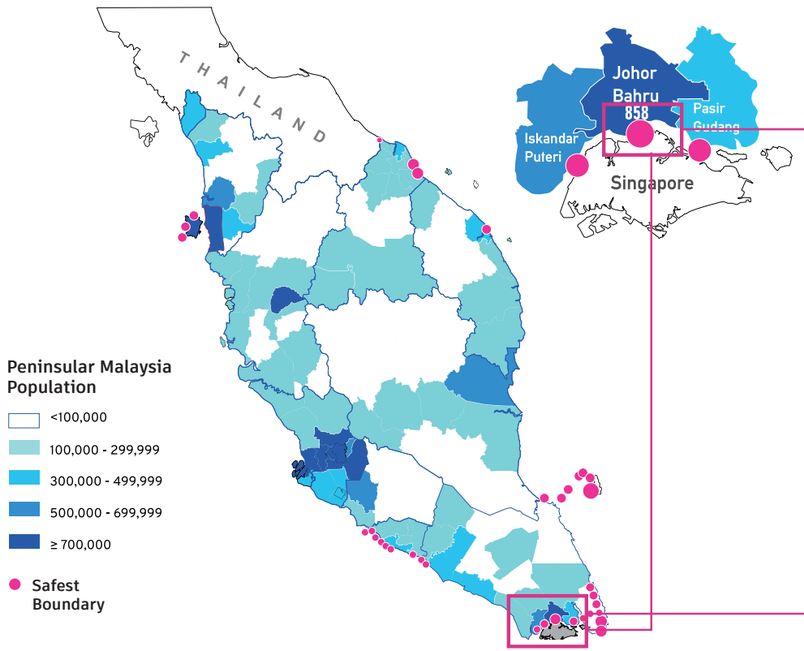
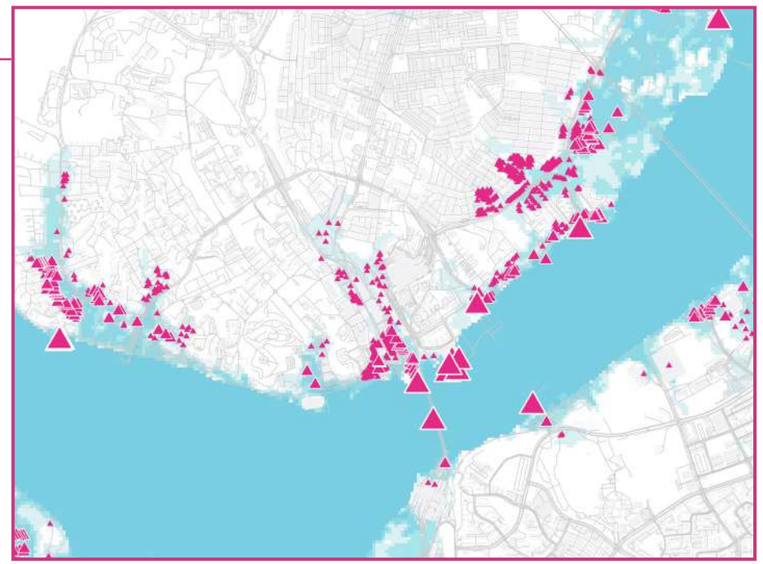
JOHOR UP↑ DOWN↓

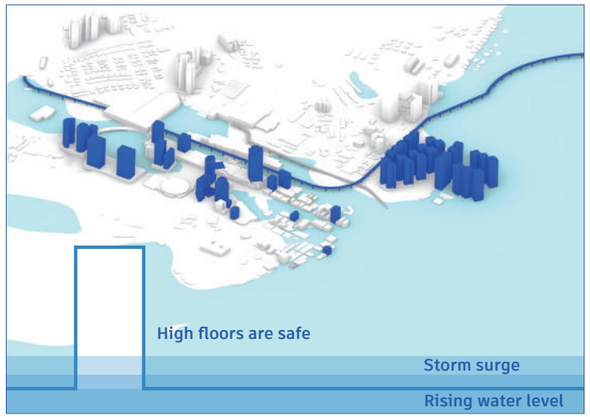
Background:
Climate change research indicates that, in the worst-case scenario, the mean sea level could rise by up to 5 meters. With the added impact of storm surges, the sea level could temporarily surge to 10 meters.

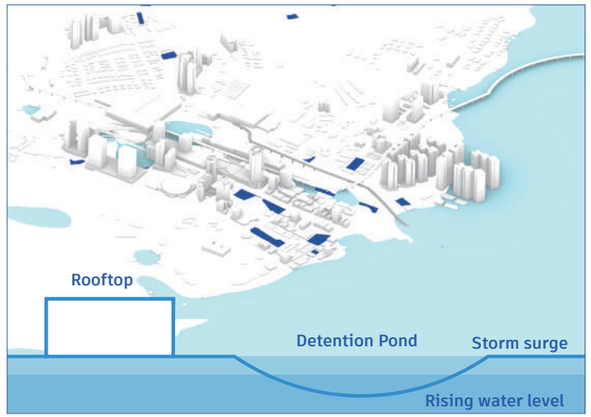
The BIG IF:
If flooding issues intensify in the future, Johor's central region—a crucial backbone for the state—faces the risk of being submerged. As a key hub for economic activity, transportation, and a densely populated area, abandoning this region is not an option. Instead, Johor must learn to coexist with water.

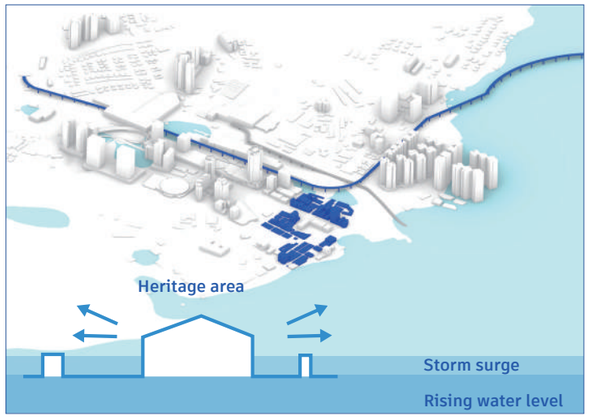
Design Strategy:
By exploring different relationships with water—living underwater, restoring water systems, waterproofing infrastructure, and building above water—I propose four core design components:
-Quick Link System (Above Water): A network of elevated pathways and transportation solutions ensuring connectivity even during floods.
-Wetland Park (Water Restoration): A natural buffer zone that restores ecosystems and mitigates flood impacts.
-Heritage Dam (Waterproof): A reinforced structure preserving historical and cultural assets while managing water levels.
-Johor Walk (Underwater): An innovative underwater experience that embraces flooding as an opportunity for adaptation and education.

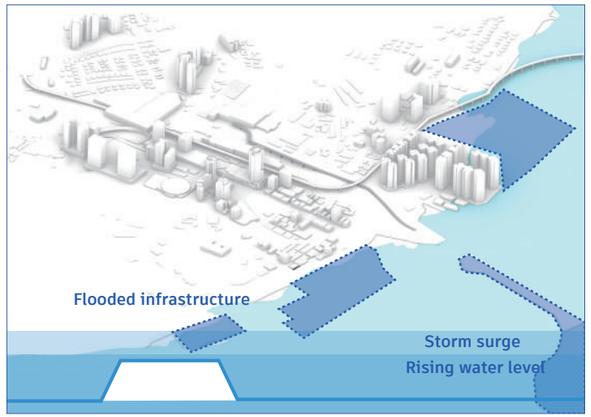








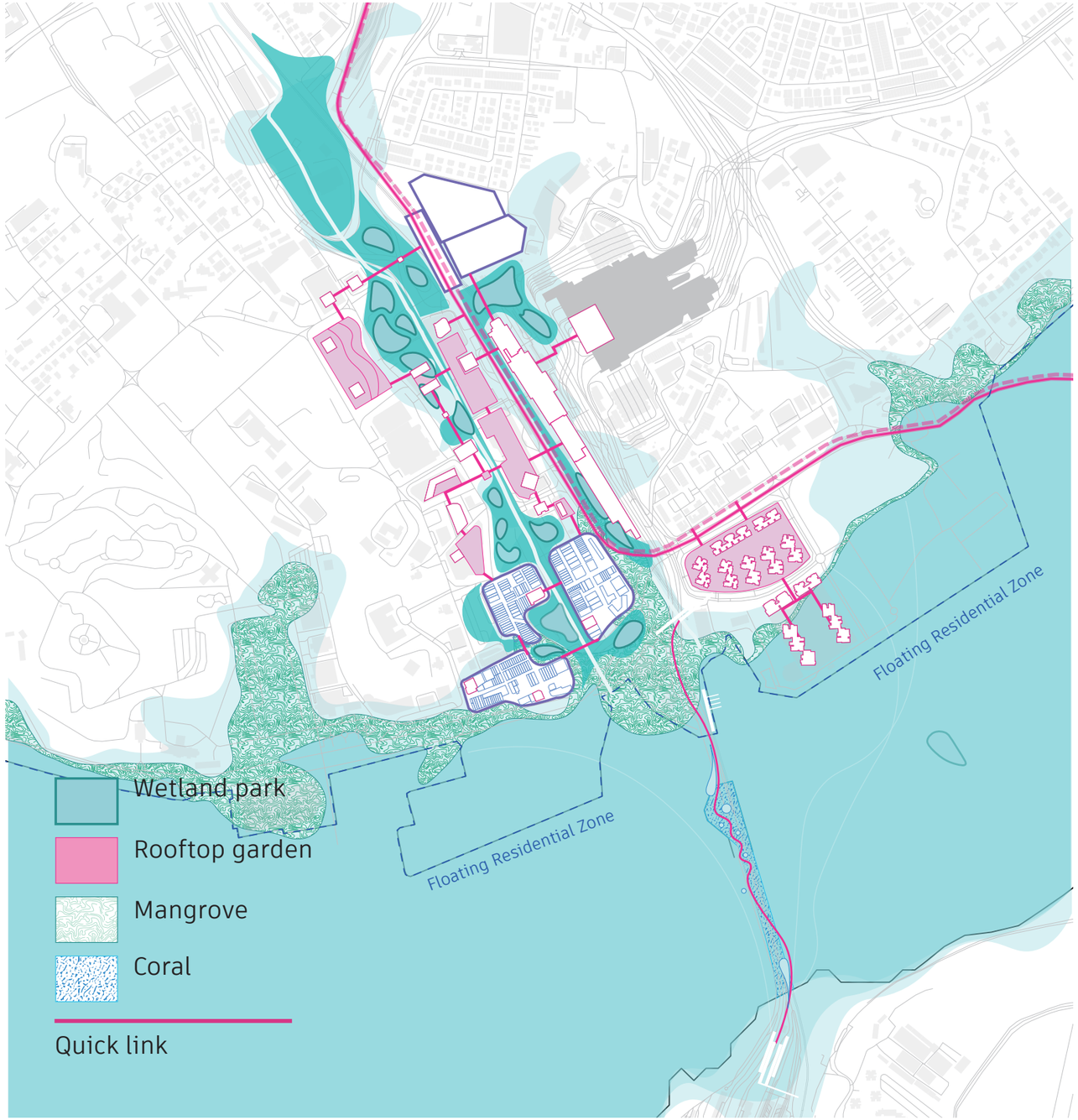


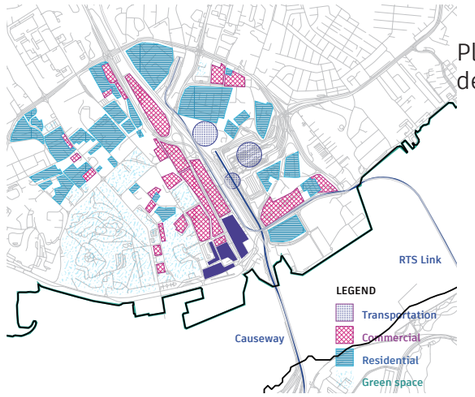


UP↑ DOWN↓

Research Mapping and Design Strategy

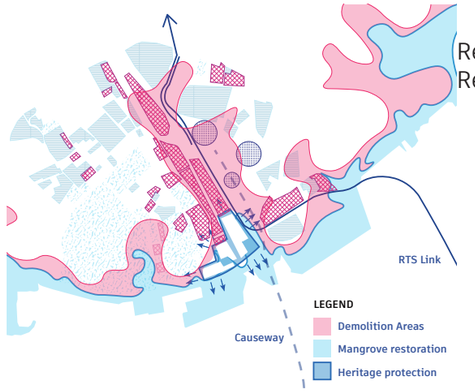
This diagram analyzes the impact of flooding on different areas within Johor's city center. Based on varying elevations, it proposes a range of design strategies from low to high elevations, specifically addressing tall buildings, urban open spaces, heritage areas, and the causeway





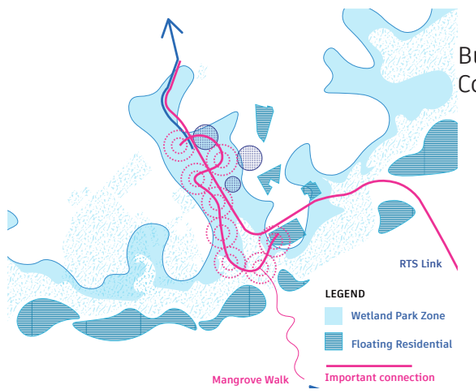
Current

Plan to address the issue of flooding while initiating the design of an elevated transportation system.



2080

Remove buildings in the 10m storm surge zone.
Restore mangroves along receding boundaries.

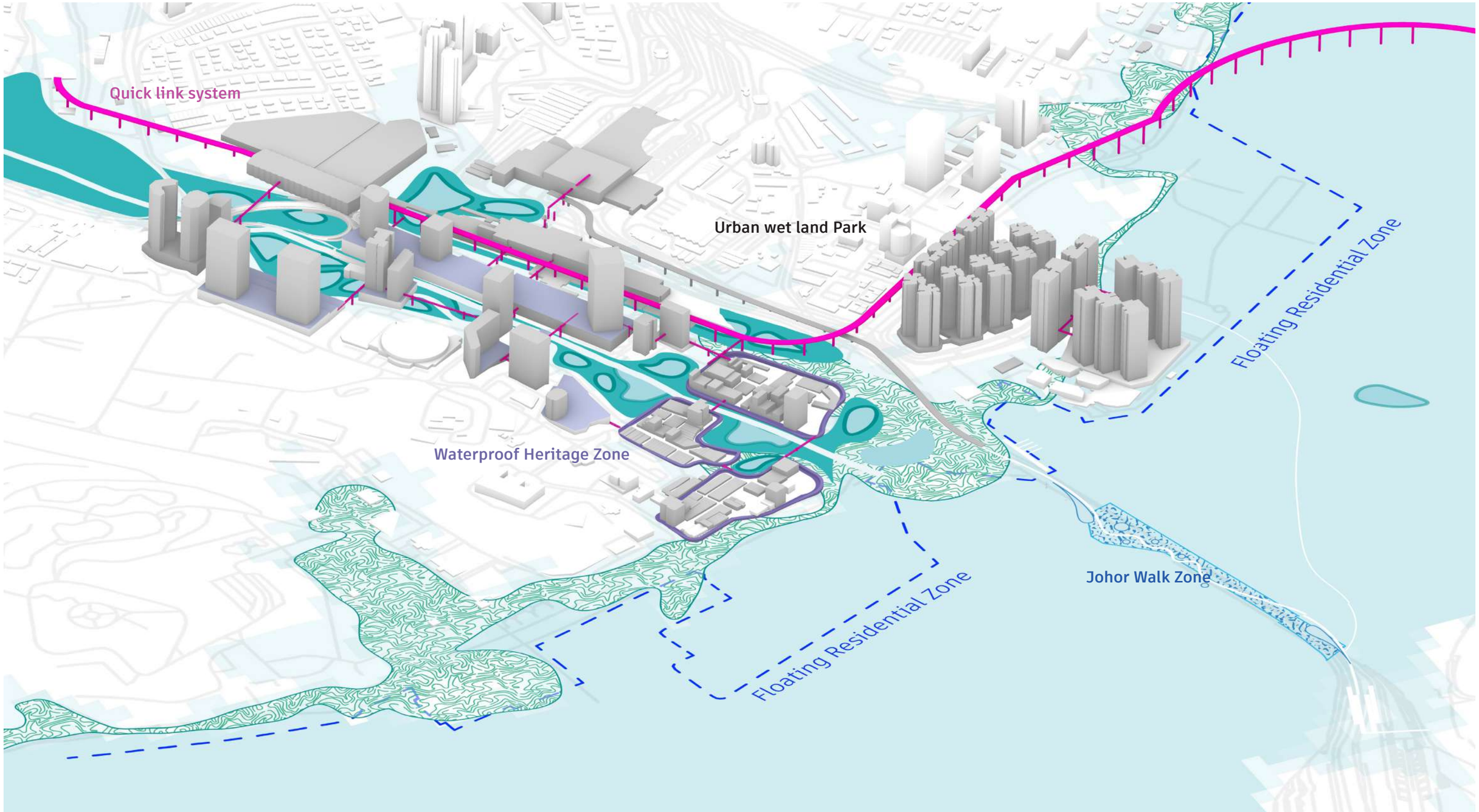


2150

Build bridges connecting tall buildings.
Construct wetland parks in open spaces

Master Plan of Johor City Center

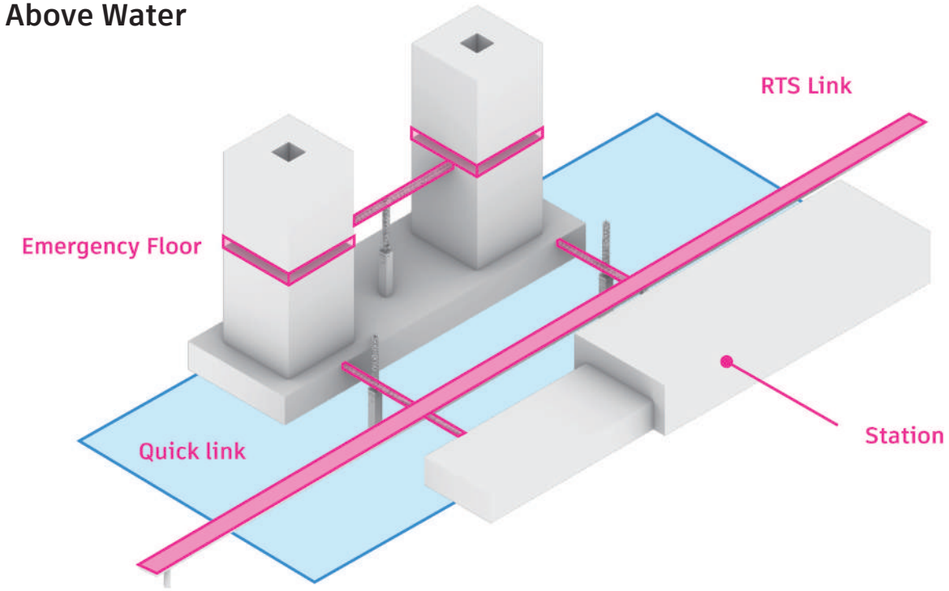
This diagram presents the future master plan for Johor City Center in 2150 and outlines key stages of its development:
Current: Address flooding issues while initiating the design of an elevated transportation system.
2080: Remove buildings within the 10-meter storm surge zone and restore mangroves along receding coastal boundaries.
2150: Construct bridges connecting tall buildings and develop wetland parks in open spaces.



Isometrics Perspective of Site

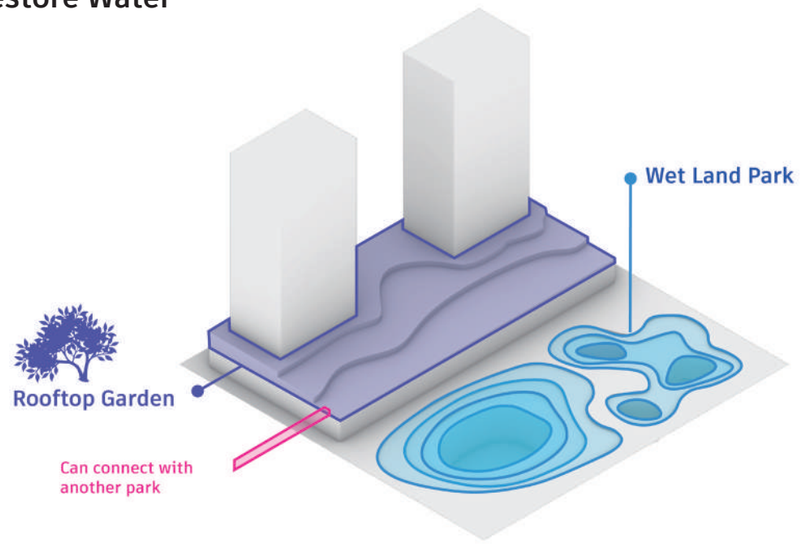
This drawing illustrates the relationships between several key design components:
-The Quick Link System connects all major rooftop gardens and tall buildings.
-Parking lots within the Storm Surge Zone have been transformed into wetland parks.
-The Heritage Zone, protected by dams
-The Causeway Area, envisioned for future underwater recreational development, have been reimagined as the Johor Walk Zone.

Above Water



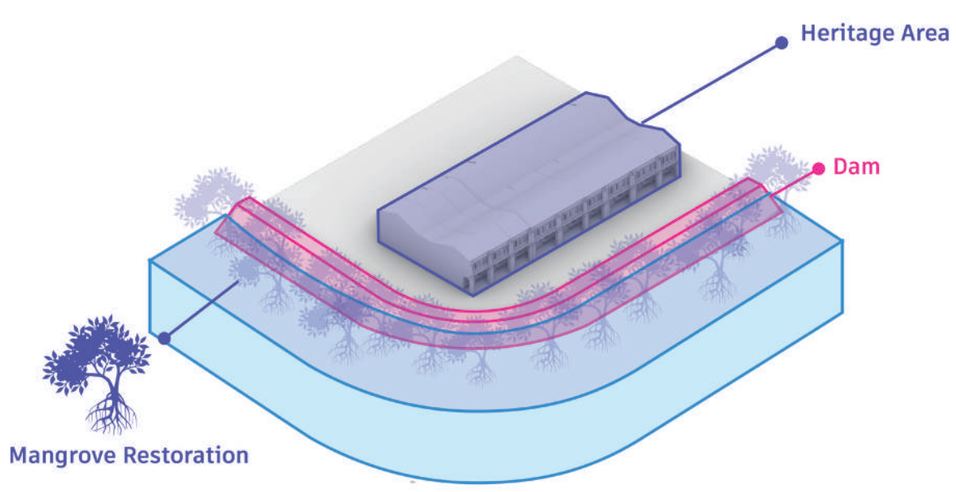
Leverage existing tall infrastructures, buildings, and RTS links to create adaptable pathways capable of adjusting to varying heights. These pathways will serve as emergency evacuation routes during disasters, forming a comprehensive elevated pedestrian network for the future of Johor city.

Restore Water



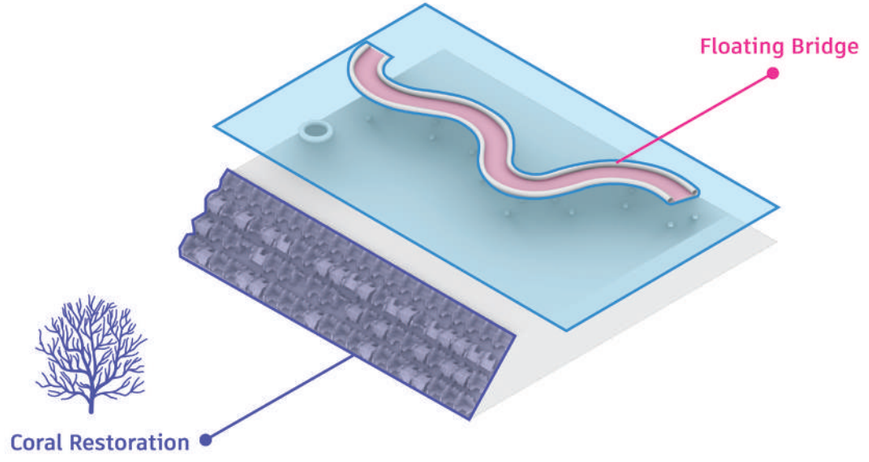
Transform existing urban parking lot prone to flooding into wetland parks, integrating them with rooftop gardens. Beneath the wetland parks, incorporate detention ponds to store excess water, enhancing flood resilience while promoting ecological connectivity.

Water Proof



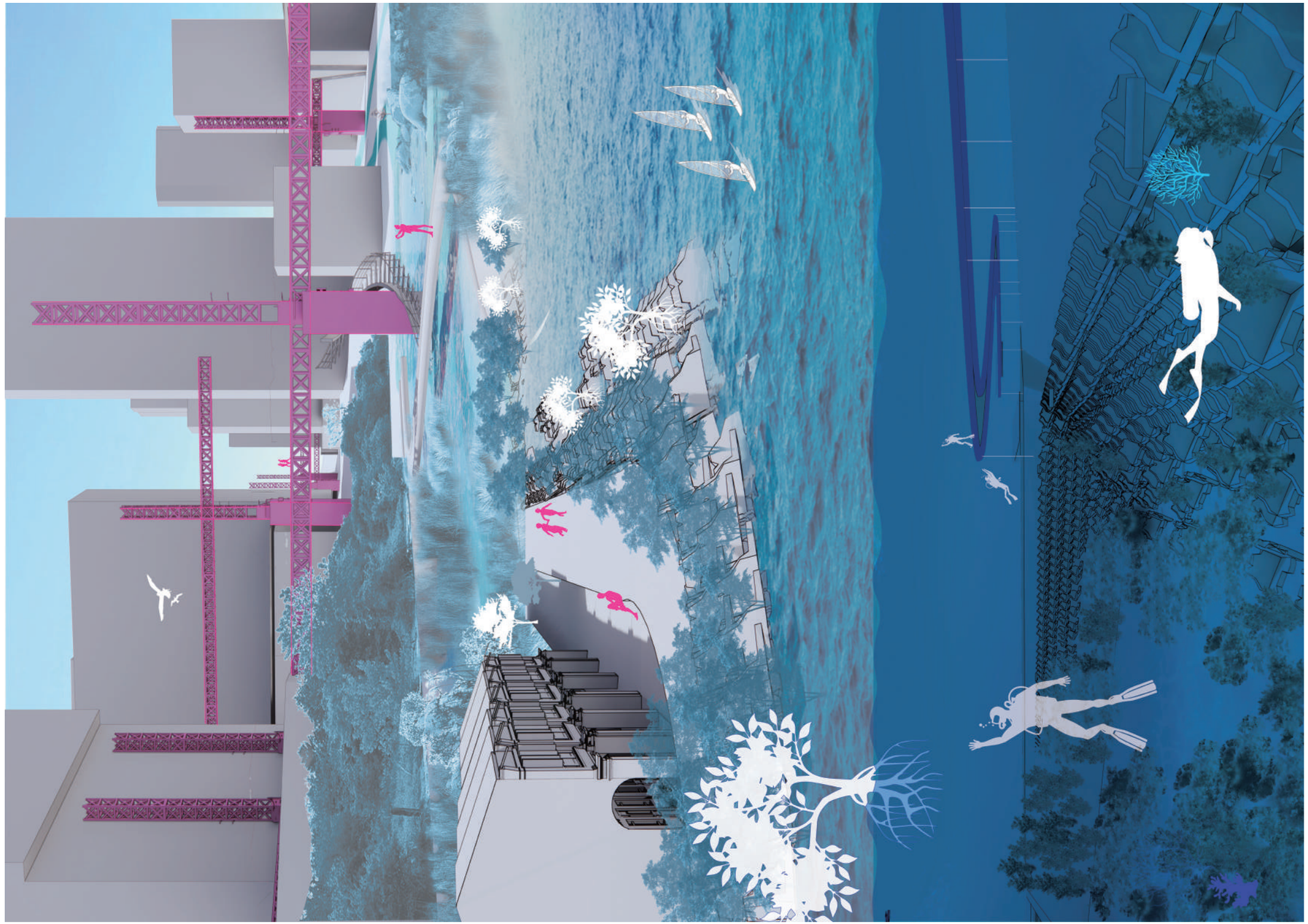
Build a dam to protect the heritage area, incorporating stone piles constructed from recycled bricks on both sides. These piles create a suitable habitat for mangrove growth, enhancing natural coastal defenses while promoting biodiversity.

Under Water



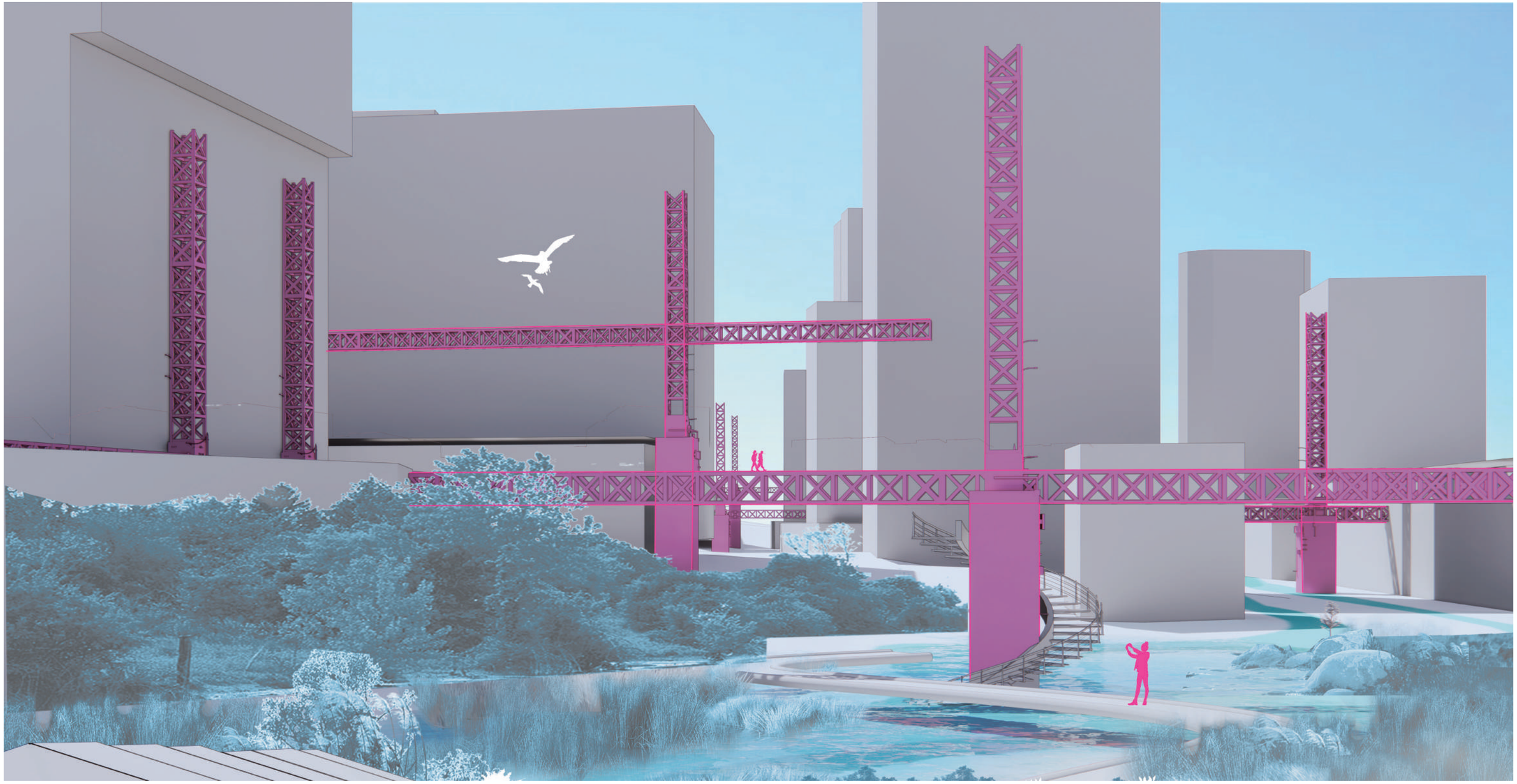
Repurpose submerged infrastructures, such as the causeway and reclamation land, into habitats that support coral and mangrove restoration. Install fixed anchor points on these large structures to accommodate floating bridges, creating opportunities for recreational activities across the strait

Design Strategy Prototypes



Rendering

This rendering shows the future scene of Johor Up Down, from the under water part to the wet-land park to the roof garden and quick link bridge above. Rich and colorful activities



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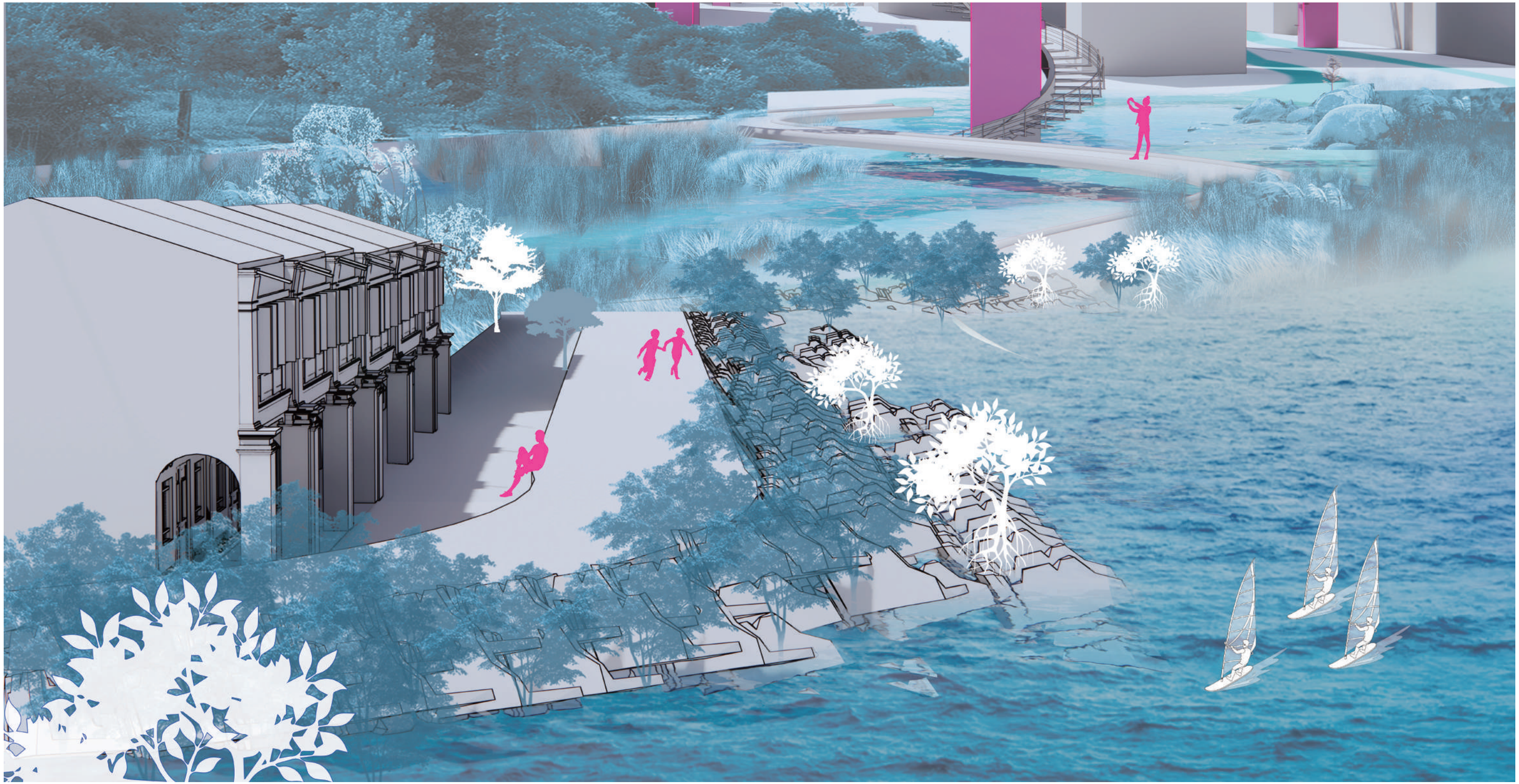

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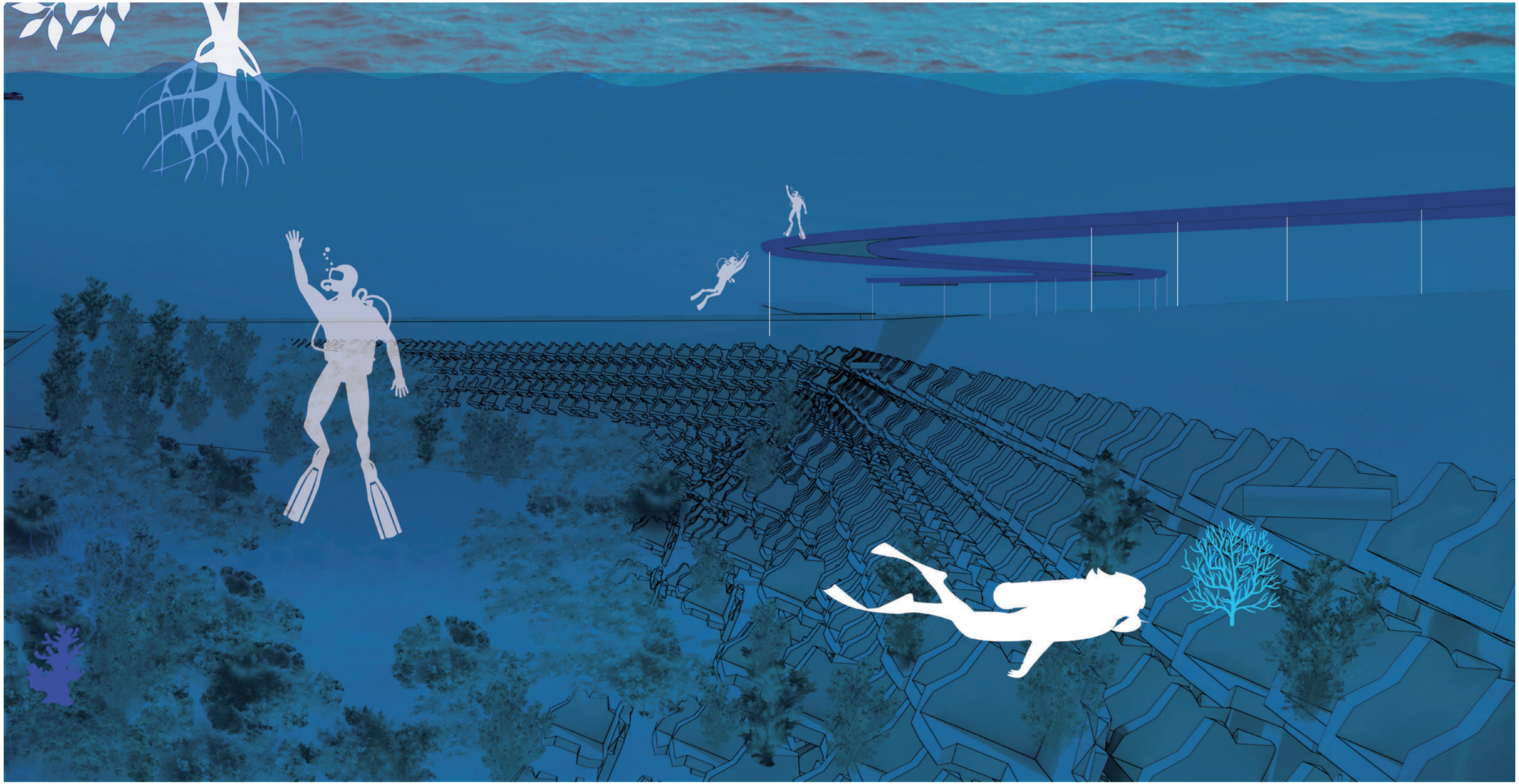

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